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LEISURE EDUCATION:

AN APPLICATION OF LEARNING STYLE THEORY

TO ZOO VISITORS

by

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Abstract

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Casual adult zoo visitors completed a questionnaire which included their preferences for particular exhibit types and a learning style assessment instrument (either David A. Kolb's 1985 Learning Style Inventory or The Gregorc Style Delineator). Two subsamples were observed at different exhibits. The analyses focused on determining whether visitors' learning styles (as defined by the formal education measures) were related to their behavior at exhibits or their preferences for specific displays. Findings were more often than not in accordance with theory. Nonetheless, the indirect nature of the results suggests that neither learning style typology could provide definitive exhibit design guidelines. Aside from a possible gender bias, the typologies are both very individualistically oriented. In a socially interactive

leisure environment, people do not function in a self-absorbed manner, as they may in a classroom. Moreover, without education as the primary objective, personality attributes other than learning style come into play. It is the context, therefore, that is proffered as the factor responsible for eliciting particular style characteristics. Hence, informal education settings seem to require their own typologies, based more on "social experiencing" than on learning style per se.

to the memory of my father

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CHAPTER I:

INTRODUCTION

Rationale

To design exhibits which successfully communicate with visitors, it is widely acknowledged that an understanding of audience characteristics is necessary (Miles & Clarke, 1993). In fact, the initial step in any communication effort is to define the target audience. As Read (1972, p. 15) advises, "Effective communication does not start with knowing your subject. It starts with knowing your audience and the reason or reasons for communicating with them."

Zoo visitors could be categorized by a variety of variables. What is needed, however, is a typology of visitors which will assist with the development of educational exhibits within zoos.

The Wildlife Conservation Society is currently developing the Congo Forest complex at the Bronx Zoo/Wildlife Conservation Park. This innovative project combines a wildlife sanctuary with an environmental education center. It holds great promise for engaging visitors in wildlife conservation. Two of the basic concerns for this new facility are: (1) what is the best way to express the message and (2) which visitors will be most inclined to get it.

In formal education settings, the idea of catering to different learning styles[1] has been shown to ease the learning process and promote positive attitudes. Consequently, Plaisance (1984), in a review of learning styles research, suggests that zoo educators "make sure there is something [emphasis added] designed for members of each of the four major learning styles" (p. 411). She reasons that interpretive displays formulated according to such protocol would more likely be "relevant" to the majority of the zoo audience.

Classifying zoo visitors according to learning style could, indeed, prove insightful. On the one hand, the four learning styles resulting from Kolb's (1984) experiential theory have been shown to correspond with certain personality types, educational specializations, professional careers, and current job roles. On the other, leisure choices are influenced by personality types and socialization as well (Allen, 1982; Kelly, 1982).

If it could be demonstrated that learning styles exert a significant influence on behavior or exhibit-type preferences in a leisure setting, it might be possible to establish design guidelines based on the visitor characteristics associated with each style. In this way, rather than haphazardly

[1]"Learning style refers to the method or way in which an individual prefers to take in and process information" (Plaisance, 1984, p. 406). It has also been defined as "a biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some and ineffective for others" (Dunn, Beaudry, & Klavas, 1989, p. 50).

recommending that "something" be provided for each learning style, the "something" (e.g., exhibit component) could be more precisely prescribed.

Schroeder (1991), in an unprecedented study, found that the learning styles of museum visitors significantly influenced what they learned from exhibits. He employed the shortest form (50 items) of the Myers-Briggs Type Indicator (MBTI) to assess learning style and did not include individuals with small children in his sample. In a zoo setting, where a significant proportion of the audience includes visitor groups with small children, neither of these conditions is acceptable on a practical basis.

A need exists to find a learning style instrument more conducive to an informal environment with regard to administration time. Moreover, the influence that a visitor's learning style has on his/her preference for, interaction with, and learning from various exhibit types needs to be further explored. The present study set out to meet these needs.

It is important to note, however, that a typology based on learning style was chosen due to its theoretical merit, which in no way assured the external validity of such a classification system. That is to say, learning styles may prove insightful for individuals; however, a zoo visit is a social event. Consequently, such a typology would be useful in prescribing successful exhibits only in so far as it also acknowledged the social context.

The ultimate goal of this line of inquiry is to characterize subsets of visitors according to some type of "learning style" and then to develop specific design guidelines based on these styles to assist curators and exhibit designers in creating more educationally successful zoo exhibits.

The Need to Promote Education at the Zoo

Historically zoos have been recognized by the general public as leisure centers. This shallow image, however, disparages the modern institution's total purpose. Today most accredited zoos uphold the goals of conservation, education, and research, as well as recreation.

In fact, conservation of wildlife is the ultimate purpose of most North American zoos today. The magnitude of the problem, however, dictates the need for a larger measure of aid than zoos and conservation organizations themselves can provide. In order for zoos to have a more significant effect on the conservation of wildlife, they must educate the "masses" about this grave dilemma. Tremendous changes must be enacted by the public if the current trend is to be altered and a portion of the diversity of life is to be saved. Hence, Article IV, Section 4 of the charter and bylaws of the

American Association of Zoological Parks and Aquariums reads: "To advance public education on the need for wildlife conservation and preservation" (Wakeman, 1986, p. 390).

While zoos increasingly characterize themselves as educational institutions, many people continue to visit expecting a recreational experience. To satisfy the goals of both the zoo and the visitors, education and leisure must somehow be merged.

Leisure

In the leisure literature, studies have examined both the motivations for which people choose leisure activities and the satisfactions which people derive from engaging in them. (Of course, there is no definitive separation between these two concepts due to their interrelated nature.) Crandall (1980) suggests three approaches to research in this area:

> An activity approach would analyze characteristics of activities or the setting,...the person approach might look at personality, life cycle differences, moods or demographic characteristics which would relate to leisure motivations or satisfactions [and] a reasons approach would look at factors such as motivations, needs, and satisfactions. (pp. 50-51)

One way of gaining an understanding of the variables important to leisure is to compare and contrast leisure to work. Using a "reasons approach," Pierce (1980) conducted a study to discover the fundamental satisfaction dimensions applicable to both leisure and work. He reports that the resulting data demonstrate predominantly positive correlations between leisure and work satisfactions for individuals. He then relates these findings to two leisure theories:

> Generalization theory (Witt and Bishop 1970:66) is that individuals tend to do the same, or at least similar, activities in both work and leisure....Their theory predicts, in other words, a certain motivational consistency which is expressed in both leisure and work...[In contrast,] compensation theory (Neulinger 1974:12; Witt and Bishop 1970:65) is essentially that individuals seek to satisfy in leisure those motives that are blocked in work...That is, a satisfaction not obtained in work would be sought, and presumably obtained to some degree, in leisure. A satisfaction successfully obtained in work would not be sought in leisure. (pp. 16-17)

Pierce concludes that the findings are more consistent with generalization theory, because "it appears that if a satisfaction is obtained in one sphere, it tends also to be obtained to a similar degree in the other sphere" (p. 17).

Using a "person approach," Allen (1982) found that there was a fairly strong relationship between 12 of Murray's personality needs[2] and 7 categories of leisure interests. Though all human needs are not fulfilled through leisure experiences, Allen concluded that "leisure behavior is motivated by a specific subset of personality needs" (p. 74). He was able to identify four personality types as they related to general areas of leisure interest.[3]

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[2]"A need is a hypothetical construct which stands for a force in the brain. It organizes the way people perceive, think, feel, and act" (Allen, 1982, p. 64). Even though Murray identified 12 physiological and 28 psychological needs, only 20 needs were included in Allen's study.

[3]Tinsley and Johnson (1984), however, take issue with the fact that "Allen reports no evidence that the respondents were knowledgeable about or had actually participated in the

In an attempt to merge activities, needs, and people, London, Crandall, and Fitzgibbons (1977) used a three-mode factor analysis. They describe how different subgroups of individuals viewed clusters of leisure activities as satisfying different needs.

The aforementioned research indicates that people participate in leisure activities for different reasons. Their reasons may relate to their personality and/or to their profession. Hence, when examining the preferences and satisfactions of those engaging in a particular leisure pursuit, such as zoo visitation, it may be possible to specify subgroups of participants based on their personal characteristics.

Education

In further pursuit of the integration of education and recreation, we turn now from leisure to explore the relevant aspects of education. Here our investigation requires focusing on two distinct subdivisions: informal education and formal education. The education which occurs in leisure environments is considered to be informal learning. As Screven (1986, p. 7) describes, "Informal learning is

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leisure activities they rated...[Consequently, they suggest that] the interest data confound personal experiences with stereotypic impressions" (p. 235). Therefore, they conducted a study using the informed opinions of experienced participants to rectify this matter.

nonlinear, self-paced, voluntary, and exploratory." Formal learning, on the other hand, is that which takes place in or in association with school classrooms.

Informal learning in leisure environments is examined within the visitor studies literature. The environments subsumed under this leisure title generally include museums, zoos, aquariums, and historical sites. The commonalities among these settings with regard to visitors are assumed, in most cases, to outweigh any differences, so they are incontestably clustered as one. Consequently, research findings from one type of leisure setting are often appropriated by other types of institutions as if they were equivalent environments.

Because the field of visitor studies has a more extensive history in museums, it is from this domain that much of the informal learning research emerges. Though some caution is advisable in transposing findings across settings (Bitgood & Thompson, 1987; Milan & Wourms, 1992), the fundamental similarities of leisure environments allow for the appropriate cross-application of certain principles. Therefore, although our primary concern is a zoological park setting, we will also survey the museum literature because many of the visitor studies conducted in museums deal with comparable informal learning issues.

The contrast between informal and formal learning environments is illuminated by Gurian's (1982) comparison of characteristics of schools with those of museums:

> A. A school generally has many bonded groups (e.g. grade 3)....The museum's main audience is generally individual or small family units.
> B. The school experience is usually coercive....The museum experience is usually a wholly volitional one.
> C. Schools deal with incremental learning....Museums generally meet their audience once and must deal with "instantaneous" learning.
> D. ...the teacher...determines the order and method of the instruction. In a museum a visitor at least determines the order, magnitude and duration of the experience.
> E. ...[In schools,] members of a subgroup are usually learning the same subject for the same period of time. In a museum, the visitors enter continuously and leave when it is convenient for them.
> F. Schools use primarily words and pictures--two-dimensional materials for instruction....the purpose of the museum is focused on three-dimensional objects. (p. 19)

Falk, Koran, Jr., and Dierking (1986) also enumerate the dimensions in which informal (museum) learning is distinct from formal learning:

> 1) Museums are free-choice settings, both in regard to attendance versus nonattendance and with respect to involvement versus noninvolvement once in attendance....
> 2) Museums are generally nonevaluative and noncompetitive. Evaluation and competition, when present, are the result of intrinsically, rather than extrinsically, imposed criteria.
> 3) Museums are perceived as places which are potentially conducive to, and supportive of, very specific kinds of learning, rather than as a generalized learning environment, such as a classroom. Museums thus provide contextually relevant learning opportunities.
> 4) Museum learners are heterogeneous with regard to age, social background, and motivation. This contrasts sharply with the homogeneity of most formal educational environments.
> 5) Museums are social settings that encourage group learning. In fact, almost all activities within museums are highly socially mediated, and involve social groupings of the <u>visitor's</u> choice. (pp. 504-505)

Within these delineations no distinction is made between child and adult learners. The amount of "control" over the experience attributed to museum visitors, however, may be more applicable to adults than to children. Nonetheless, these characterizations emphasize the different affordances of these two settings.

Informal Learning
In Zoological Parks and Museums

Aptly expressing a view held by contemporary zoos, Leiweke and Waterhouse (1990) proclaim,

> Though the breeding and care of our zoo animals is extremely important, the preservation of their brethren still remaining wild must be our highest priority. The only true justification for holding wild animals captive for exhibition in our zoos today is the role they can play in engaging our visitors in the conservation of all wild animals. Thus, we believe the most critical animal in the zoo is the visitor, because together, those visitors hold in their hands the destiny of wild places everywhere, and all that lives there.
>
> Zoos' efforts at breeding captive stock for the preservation of particular species, and even their replacement in the wild, treats symptoms, not causes. Unless we are effective in changing human behavior, the primary source of wild habitat destruction, zoos are destined to become museums of creatures that used to exist in the wild. (pp. 443-444)

Though wildlife conservation may be the ultimate purpose of many zoos, the more immediate objective of educating the public about the relevant issues may be the key to accomplishing this higher goal. As Rabb (1985) concurs, a zoo's "principal contribution to conservation is not likely to be the number of golden lion tamarins returned to the wild but rather the education of millions about the underlying causes for such an extraordinary effort" (p. 19).

The literature regarding learning in zoological parks and museums focuses primarily on how to convey an educational message to a leisure-time crowd. In the museum context, learning "refers to any measurable changes taking place within the visitor which can be directly attributable to the exhibit experience" (Lakota, 1976, p. 249). Likewise, exhibit effectiveness may be defined as "a measurable change in viewer behavior produced by the exhibit and consistent with the stated aims or objectives of the exhibit" (Shettel, 1973, p. 36). What is this change in the viewer? It is informal learning.

In museums numerous studies have recently been conducted to evaluate the effectiveness of various display media (Eason & Linn, 1976; Koran, Koran, & Longino, 1986; Peart, 1984), exhibit designs (Bitgood, Nichols, England, Tatum, Carnes, Hahn, & Patterson, n.d.; Kremer & Mullins, 1992; Van Rennes, 1978), labels/interpretive text (Borun & Miller, 1980; Lakota, 1976; McManus, 1989; Screven, 1986), adjunct devices (Screven, 1974a, 1974b, 1975), tour formats (Sakofs, 1984; Stronk, 1983), and field trip experiences (Balling & Falk, 1980; Carlisle, 1985; Gennaro, Stoneberg, & Tanck, 1984; Gottfried, 1980; Tuckey, 1992).

Textual Interpretives

As zoos have long relied on signage to convey their messages, several studies conducted in zoos involve the characteristics of labels and interpretive text (Serrell, 1988a; Zaremba, Toedter, & Fassl, 1992; Wolf & Tymitz, 1981). Bramley (1992), for instance, advises the use of a theme that can be reinforced both by short animal identification labels and by larger panels throughout the park.

Veverka (1990) likewise advocates a theme approach to interpretive planning, because "visitors will not remember very much from reading 100 to 200 individual animal signs." But "people can remember 2 to 5 main concepts, if those concepts are repeated, over again, in different ways, with different illustrations, with different animals" (p. 523). By using this approach, he explains that the "main concepts will be repeated, in a variety of ways, to reach a variety of audiences, using a variety of learning styles - but the story doesn't change" (p. 524). He asserts the following:

> This approach to interpretive planning (a visitor oriented approach based on knowledge of how and why visitors learn and remember information) will prove to be a cost effective method of communicating to visitors why zoos are important, and how (and why) they should support conservation work being conducted around the world (or in their own state). (p. 524)

Yet behind this vague plan the necessary details appear to be lacking. For instance, the main concepts should be repeated in what ways? to reach whom? using which learning styles? We must seek to develop more specifics.

Serrell (1988b), who has conducted much research on graphics, describes an approach to creating interpretive labels designed to reach a multi-level audience. She explains that the idea to use a layered approach stems from the fact that a zoo

> audience is made up of diverse categories of people, in terms of age, nationality, education, and income; that they come to us [zoos] with a variety of interests, motivations, needs, and time to commit to a visit; and that their prior knowledge about the topics discussed in labels varies widely. (p. 178)

She admits that "visitors have different styles or preferences for learning through different modes of information, such as visual pictures, tactile experiences, listening to talks or tapes, reading, sharing personal experiences, or telling stories" (p. 179). Consequently, she suggests the following strategies for developing layered interpretation: "vary conceptual styles of information throughout the exhibit," "vary the mode of graphic presentation by pictures and words," "vary the requirements for physical activity," "layer in more humanity" (e.g., by presenting quotations and first-person stories), and "provide physical layers through various heights" (p. 180).

Again, an ambiguously diverse audience is dealt with by employing multiple measures so that there will be something for everyone. When attempting to reach the general zoo audience, this might be the most effective strategy. However, when narrowing the focus to a particular exhibit with a target audience, if the visitor characteristics could be specified, the most appropriate strategies could be identified as well.

Although these authors do not provide specific criteria upon which to base their schemes, they do suggest visitor differences which necessitate their propositions. Among these differences, they acknowledge the existence of various learning styles across visitors. Toward the goal of effecting successful communication, this appears to be a facet worth pursuing.

Participatory/Interactive Exhibit Components

Beyond signage, other techniques to enhance learning have come to the fore. Participatory exhibits, for example, are a popular trend. This exhibit type is rooted in the philosophy that the more the learner is immersed in his/her own learning, the greater will be his/her capacity to comprehend and recall. Shettel (1973), in fact, asserts that active participation in a "relevant activity" "heightens the acquisition and retention of information" (p. 40). Bitgood, Patterson, and Benefield (1986) meanwhile, report that "devices that involve some type of manipulation or participation by the visitor increase the holding power of the exhibit" (p. 729). Thier (1984) moreover, emphasizes that "interaction increases interest in exhibits and encourages visitors to seek additional information on the topics presented and its importance to their lives" (p. 95). In addition, Leiweke and Waterhouse

(1990) contend that "behavior-changing learning experiences must have a powerful emotional context and...powerful emotions can be elicited better by participation then [sic] by simple observation" (p. 444).

According to Moscardo and Pearce (1986), authors dealing with museum learning suggest that in "voluntary learning situations visitors have to be motivated and encouraged to engage in learning...[thus,] exhibits must allow the visitor to participate in the learning process" (p. 92). "This active participation results in changes in schemata or learning and in enjoyment and is seen as the explanation for the findings that participatory exhibits are more effective in promoting learning" (pp. 92-93).

This prompts these authors to ask, "What are visitors doing, then, when in front of non-participatory exhibits?" (p. 93). Their answer to this comes from the concept of mindlessness, which may be defined "as a mental state where there is little questioning of new information and where individuals are mentally passive and are processing the environment according to pre-existing scripts and routines" (p. 93). In contrast, "mindfulness is characterised by detailed attention to a task or activity and analytic processing of material resulting in changes in cognitive structures" (p. 93). Accordingly, "passive exhibits induce mindlessness and consequently little learning, while interactive exhibits induce mindfulness and thus active processing of information" (p. 93). Moreover, they note that research has found mindfulness to be associated with satisfaction and enjoyment.

Moscardo and Pearce used this background to conduct a secondary data analysis of material originally collected on 17 British visitor centers. They found that there was no relationship between information recall and enjoyment; however, there was a positive relationship between mindfulness[4] and visitor enjoyment. They concluded that "direct factual questions on displays at the centres may not be a sufficiently sensitive measure of the learning experiences of visitors' (p. 104). Rather than information recall (a formal educational definition of learning), the more appropriate goal of informal education may be mindfulness. Furthermore, "it appears to be necessary to provide a highly specific interpretive theme and to vary the kinds of high quality interpretive technique [sic] used at the centre" (p. 106).

Alt and Shaw (1984), however, suggest that although it is widely accepted in mainstream formal education that the learner should be actively involved in the act of discovery, this may not be appropriate for the casual museum visitor.

[4]Their measure of mindfulness included: (1) visitors' subjective knowledge (i.e., visitors' own appraisal of whether or not they had learned something new at the center), (2) their score for information recall, (3) their score for wanting more information about the topic in the center, and (4) their score for wanting more information to be provided by the center.

According to their research, "there are a number of other requirements associated with the ideal exhibit, of greater importance than interaction or participation" (p. 32).

> For participatory exhibits to be successful there must be a (perceived) pay-off between stopping and receiving information without the necessity of having to invest too much time and effort. This suggests that for participatory exhibits to be successful, the act of participation must itself be informative, and that participation as a means to obtain information is not good enough. (pp. 34-35)

Nonetheless, the predominant theme to emerge from Rosenfeld's (1979) naturalistic study of family visitors at the San Francisco Zoo was their search for interaction. This theme was expressed in the following ways:

> First, people spent the most time at exhibits where animals interacted with each other or with the visitors....Second, zoo-goers often tried to initiate interation [sic] with animals in numerous ways, including feeding (ignoring the zoo's no-feeding policy), mimicking, and petting the animals. Third, people also tried to attract and interact with the non-caged animals, such as the squirrels and pigeons. Finally, visitors interacted frequently with other members of their group--talking, laughing, sharing food, touching, and pointing things out to each other. (p. 2)

As a result of this research, Rosenfeld (1979) conducted a subsequent study to investigate the reactions of visitors to interactive learning experiences. The setting was the Animal Fair, a mini-zoo located on the back lawn of the Lawrence Hall of Science. The Animal Fair included six exhibits of common animals and six interactive Zoo Games. Rosenfeld found that "although people were immediately attracted by the animals, they spent most of their time where there were the greatest opportunities for interaction," i.e., the Zoo Games (p. 3). In addition, "the children interacted with the animals and Zoo Games significantly more than the parents did, while the parents read signs significantly more than the children did" (p. 3). Rosenfeld also found that children gave experiential definitions to the concept of "learning;" that is, "they did not differentiate between their own experience of the Animal Fair and what they felt they had learned there" (p. 15).[5]

Derwin and Piper (1988) conducted a post-occupancy evaluation of the African Rock Kopje exhibit at the San Diego Zoo in order to assess the effectiveness of its interpretive elements. Similar to Rosenfeld's results, they found that "younger visitors were more likely to use the interpretive elements than to read panels, while older visitors were more likely to read the panels than to use the interactive elements" (p. 435). Moreover, "although it was expected that the adults accompanying children would read the panel information to them, that was not observed during visitor

[5]This finding may not be so surprising. It is reminiscent of Piaget's theory, which describes how

> the growing child's system of knowing changes qualitatively in successively identifiable stages, moving from an enactive stage, where knowledge is represented in concrete actions and is not separable from the experiences that spawn it, to an ikonic stage, where knowledge is represented in images that have an increasingly autonomous status from the experiences they represent, to stages of concrete and formal operations, where knowledge is represented in symbolic terms, symbols capable of being manipulated internally with complete independence from experiential reality. (Kolb, 1984, p. 13)

tracking" (p. 445). "The tracked visitors reported that they felt the signs to be important, more important even than the interactive elements, yet most did not read even as few as three panels" (p. 449).[6] On the other hand, 79% of these visitors touched or used at least one interactive exhibit element. Most importantly, "the interactive elements significantly helped cognitive recall when compared to information presented without interaction" (p. 435).

As implied by the previously cited studies, interactive components do not appeal to everyone. Miles (1988), in fact, reports the existence of three subgroups of visitors (at the British Museum of Natural History) whose attitudes toward dynamic media of communication (e.g., audiovisuals or computers) significantly differed. "Although these groups shared similar evaluations of other exhibit characteristics, 'Traditionalists' (19% of the sample) ranked dynamic media as undesirable, in contrast to 'Modernists' (34%) and 'Neutralists' (47%) who, in different degrees, found them desirable" (p. 166).

All in all, the literature seems to suggest that many visitors, especially children, spontaneously seek interaction. Even though other characteristics of exhibits may be equally

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[6]A relatively strict definition of "reading" was employed in this study. "'Reading' was assumed to occur when a visitor appeared to go beyond the headline, moved his or her head from left to right, focused on the text for more than 20 seconds, or paraphrased or read aloud to an adult companion or to a child" (Derwin & Piper, 1988, p. 439).

valued, participation may in fact enhance informal learning. For the zoological park setting however, interactive elements are not unconditionally extolled.

Jenkins (1985) developed a survey of interactive technologies based on the nature of the activity involved. While he praised the potential of these devices, he also cautioned that we must not "let the success of new technology overshadow the greater goals of conservation education. A device may work and prove very popular, but if it does not build respect and understanding for life, then we have succeeded technically, and failed philosophically" (p. 72). Lattis (1986) echoed this sentiment when he advised that the most important question to be asked when developing participatory devices for the zoo environment is: "Does it add to better understanding of the animal on exhibit?" (p. 250). If the answer is no, then the need for the device should be questioned.

Indeed, participatory components are by no means essential to informal learning. Landay and Bridge (1982) report the findings of a controlled experiment carried out in an art museum to assess the effectiveness of two presentation formats on different kinds of visitors. They conclude that "people do learn information from interpretive materials -- wall panels and videotape presentations -- in museum exhibits, and we can measure this learning." Furthermore, they found that a respondent's educational background (i.e., college graduate versus non-college graduate) had significant effects on his/her learning. Hence, they make the less-than-astounding claim, "different media have different effects on different kinds of museum visitors" (p. 54). They suggest that "multiple presentations of the same information will increase learning...both by increasing the viewer's exposure to information and by providing him [/her] with a choice of format" (p. 54).

Again, we must strive to supersede these generalized formulas. More helpful to exhibit designers would be greater knowledge concerning the form of the message to be presented by each media type in order to reach specific visitor subsets.

Participatory devices may not be the panacea for accomplishing a zoo's educational objectives. Consequently, approaches involving other forms of interaction have also been tried. For example, in the Reptile Department at the Dallas Zoo, exhibits were removed from one wall and replaced with windows allowing a view into the service area. This provides a behind-the-scenes look and enables interaction between visitors and keepers via an intercom system (Murphy & Mitchell, 1989). This is potentially an effective learning experience, as Wolf and Tymitz (1981) found that there was a strong preference among zoo visitors (at the National Zoological Park) for interactions with animal keepers and roving guides to gain additional information about animals.

__Social Context__

But it is not only exhibit characteristics which affect visitor behavior. Social influences are at play as well. McManus (1987) studied the relationship between social group composition and learning-related behavior (i.e., the use of interactive exhibits, reading behavior, talking at the exhibit, and allocation of time at the exhibit) in a science museum. She found four distinct constituencies based on similar patterns of the learning-related behaviors: groups containing children (e.g., family groups, child peer groups, and teacher-pupil groups), singletons, couples, and adult peer groups (including male dyads and female dyads).

The "groups containing children" constituency is characterized by the extreme likelihood of play at interactive exhibits, long conversational periods within the group, and a strong tendency toward longer visits. When adults were present, reading behavior was likely to be brief, and when the group consisted of child peers, reading was "non-observed" (which does not necessarily imply that visitors did not read text, as reading is difficult to observe). The singleton constituency is characterized by brief visits to exhibits and comprehensive reading. Male singletons were twice as likely not to play at interactive exhibits when compared to the sample population, while female singletons' use of the interactives mirrored that in the sample population. The couples constituency showed a lack of verbal interaction and a tendency to stay at the exhibits for long periods. Couples were likely to be comprehensive readers, but they tended to be non-players at interactive exhibits. The behavior related to the use of interactive exhibits within the last constituency, the adult social group, depended on the presence or absence of females. When the group was composed of males, the use of interactives mirrored that of male singletons save that male dyads were even less likely to use them.

McManus emphasized that "museum visitors bring with them, as part of the social context of their visit, the propensity for variation in behaviours related to interaction with the exhibit" (p. 270). She maintained the following:

> The ways in which the constituencies come to terms with the content of the museum communication may, or may not, affect their learning, but the manner in which they go about the learning task sets them apart from each other. This variation in communicatively related behaviour could act as a filter of the audience for the exhibit message if the form of the exhibit did not adequately cater for the range of learning-related behaviours which could be brought to it. (p. 265)

In another effort to investigate the operation of social factors in a science museum, Diamond (1986) conducted an ethological study of family groups. She concluded that "learning in a science museum does not occur only or perhaps even primarily as a result of the interaction between individual visitors and the exhibits;" rather, "social interactions between visitors may be important in stimulating learning at exhibits" (p. 152). Moreover,

> family members communicate in different ways and also experience objects in the environment differently. Parents read graphics more and also tend to convey more symbolic information. Children manipulate exhibits more and tend to transmit information about the location, operation, and description of the exhibit phenomena. (pp. 152-153)

Hilke (1988) also studied the social influences on museum visitors by following family groups through traditional and hands-on exhibition halls in a large natural history museum. She found that "acquiring and exchanging information was the primary focus of their activity, and the exhibits the family passed were the almost exclusive focus of these efforts to learn" (p. 121). But rather than this being a by-product of the social setting or a group effort, she suggests that "individual family visitors pursued personal agendas to learn. They made personal decisions about what they wanted to attend to, tried to find out things for themselves, and used strategies which allowed them to acquire information first-hand" (p. 123). This was true for both children and parents. "Regardless of age or generational differences, individual family members pursued their own agendas most of the time, and each had ample opportunity to experience and evaluate the exhibits independently" (Hilke, 1989, p. 128). Complementing the individualized efforts were behaviors which served to broadcast current perceptions, conceptions, and queries to other family members. By favoring cross-generational interactive partners, family members effectively distributed new information to family members with the least similar knowledge base, thus augmenting the information available to each individual member.

Individuals may indeed pursue their own learning in leisure settings. Nonetheless, the potential salience of the social context cannot be neglected. Hence, toward the goal of enhancing informal education, characteristics of individuals as well as interactions among the individuals must be considered (Blahna & Roggenbuck, 1979).

Incorporating participatory devices into the social nature of the visit has resulted in the idea of family learning centers stocked with activity boxes replete with interactive opportunities. Facilities such as HERPlab (White & Marcellini, 1986; now defunct), Birdlab, and Zoolab at the National Zoological Park and the Discovery Room, the Insect Zoo, and the Naturalist Center at the National Museum of Natural History are founded on the premise that zoos and museums can promote their educational aims while simultaneously supporting the social and recreational needs of their visitors.

Individuals' Prior Knowledge

Besides exhibit characteristics and social factors, one last dimension must be taken into account: the knowledge that visitors bring with them. Falk, Koran, Jr., and Dierking (1986) maintain that "the learners' knowledge upon entering...is a critical factor in determining what visitors choose to look at or learn from a particular exhibit" (p. 504). Screven (1988) likewise asserts that what visitors understand from an exhibit is influenced as much by their prior knowledge and preconceptions about the topic as by the exhibit itself.

In fact, Hilke (1988) concludes that a family's primary agenda in a museum is not to look for relationships within the content of the exhibition, but rather to seek relationships between their own knowledge/experience and the content/structure of the show. She explains that visitors are more likely to interpret exhibitions, not according to some exhibit theme, but from perspectives related to their own background experience, knowledge, and interests. As Miles (1988) reports, "it is not uncommon to find visitors using exhibits to reinforce their existing incorrect interpretations" (p. 166). Clearly, visitors' minds are not blank slates.

According to Baron and Hogan (1988), research "indicates that in order to enable concept acquisition, educators must go beyond presenting information in creative, hands-on ways, by taking into account what the learner brings to the learning situation" (p. 27). Tunnicliffe (1992) likewise acknowledges that identifying a learner's previous experiences and constructs is a crucial step in attempting to further this knowledge. Recognizing this observation, Bramley (1992, p. 103) calls on the first of Freeman Tilden's six principles of effective interpretation to denote the importance of "relevance," i.e., relating "what is being displayed or described to something within the personality or experience of the visitor" (Tilden, 1977, p. 9).

This sampling of visitor studies exemplifies some of the issues at the heart of informal learning. Media presentation, membership in a social group, and personal characteristics each play a part.

Exhibit Design Guidelines

In the zoological park setting, a variety of informal educational techniques exist: different styles of graphics, various interactive devices, and participatory experiences. Nonetheless, guidelines for their application seem to be lacking. These strategies are developed primarily for use with the general on-site audience. Consequently, specifics are deemed unnecessary due to the great potpourri of visitors.

One attempt to lend guidance to the educational schemes of zoos came from Plaisance (1984). After reviewing the research on learning styles, she concluded that "this research provides a model which can be used to structure information and experience in such a way that all the major learning styles can be addressed within each of our [a zoo's or aquarium's] educational offerings" (p. 411). She recommended that zoos "make sure there is something designed for members of each of the four major learning styles" (p. 411) so that the interpretive exhibits will more likely be relevant to most of the visitors.

This is a step in the right direction. Embarking on the interpretive enterprise with specific objectives seems to carry more credibility than simply relying on the curator's or designer's intuition. Of foremost significance is the acknowledgement that characteristics of the recipients of the message must be considered. In an article illuminating the importance of front-end evaluation, Miles and Clarke (1993) emphasize that

> most exhibitions are designed to be pieces of communication, and communication is a process that involves the active participation of two parties--both the transmitter of the information and the receiver. If this process is to be successful the exhibition designer, when deciding how to transmit information, needs to understand the characteristics of the visitor as receiver. (p. 698)

Taking into account one characteristic of the visitors, Plaisance insists that "something" be designed for members of each of the four learning styles. Her proposal rests on the following assumptions: (a) learning styles do indeed influence experience in a leisure environment and (b) each of these styles exists across the heterogeneous zoo audience. Can these assumptions be substantiated? Furthermore, in applying this model to a particular exhibit, the constructive details are found wanting. Design "something," but what? Perhaps a deeper understanding of the respective characteristics of the variety of zoo visitors holds the key.

Conservation Education

Aside from general education within zoological parks, let us briefly examine conservation education in particular. This discussion must, of necessity, be brief due to the present rather undeveloped state of this education in zoos. Birney (1987), in a national survey of zoo conservation programs, found that the majority of such programs which already exist in zoos pertain to highly defined audiences (e.g., teachers, school children, or formal classes). What is presently lacking is conservation education for the general on-site visitors. These programs must receive high priority status if zoos are to achieve their goal of conservation.

Toward which visitors, more specifically, should these conservation education programs be aimed? Miles and Clarke (1993) maintain that "it is necessary to define a target audience because the range of people who might visit...is heterogeneous, and an exhibition designed to please everybody would probably finish up pleasing nobody" (p. 701). Moreover, the target audience, a subset of the actual audience, "must be defined in a way that is consistent with empirical knowledge of the actual audience" (p. 701).

Berkovits (1990) announced that determining the target audience for conservation programs is one of the dilemmas facing zoo educators today. "With so many people of vastly differring [sic] ages, educational backgrounds and socio-economic strata streaming in through their gates, zoos must decide which subgroup will be most inclined to respond to the call for conservation-minded action" (p. 3).

From among the wide range of variables which could be used to classify visitors, age appears to be the only one discussed. Berkovits (1990) designated adults, older students, and teachers as more important audiences to address than young children because "as time is running out for many species we must concentrate on audiences that can give us quicker results" (p. 3). Squire (1990), likewise, recommended focusing on adult visitors since they "can make a difference today, by supporting conservation causes, using their consumer buying power to help wildlife, [and] electing environmentally aware legislators" (p. 245). She laments, "The fact is that the earth is in trouble today, and we cannot afford to wait until the children enrolled in our education programs grow up and begin to save it" (p. 244). Other visitor characteristics, besides age, must be explored in our endeavor to pinpoint target audiences for specific exhibits and interpretive programming.

The most important point for zoos to remember as they work toward their goal of conservation may well be that of Baba Dioum (a Senegalese poet):

> In the end, we conserve only what we love.
> We will love only what we understand.
> We will understand only what we are taught.

The informal education taking place within zoos certainly deserves the institution's utmost attention.

Murphy (1970) provides a fitting analogy:

> Phrased in the adage, "You can lead a horse to water but you can't make him drink," the collection is the water, the public (with due respect), the horse. A misused education department simply points at the water, saying, "Here is water, it is five feet deep, 20 feet across and it is wet." But a good education department induces a thirst. (p. 16)

How should museum or zoo exhibit experiences be designed in order to promote greater informal learning? Answers may be suggested by the ways learning is enhanced in more formal settings. For this we now look at the formal education literature.

Formal Education

Relatively recently it has been recognized that the traditional classroom is not an effective learning environment for all students. To compensate for these shortcomings, there were moves toward individualized or open programs. Again, some learners benefitted while others struggled. At last there has come the realization that it is not possible to teach all students by relying exclusively on one method. The different needs which exist among students may be explained by their differing "learning styles."

Learning Style Theory

Inquiry into the descriptions and implications of learning styles is currently a prominent topic in the education literature. According to Dunn, Beaudry, and Klavas

(1989), "learning style is a biologically and developmentally imposed set of personal characteristics that make the same teaching method effective for some and ineffective for others" (p. 50). Consequently, there have been efforts to diagnose students' learning styles and then prescribe instructional programs based on them. In essence, educators are encouraged to design programs to fit the learners rather than following the traditional notion of fitting the learners to standard programs. It is expected that such a strategy will result in more students attaining to a greater degree the ultimate goals of education.

A variety of models have been developed to define the different learning styles. Dunn, Dunn, and Price (1979) "found that learning style is the manner in which at least 18 different elements from four basic stimuli affect a person's ability to absorb and retain" (p. 41). Using these elements, the authors developed the Learning Style Inventory (LSI). This self-report instrument requires that "students answer a series of questions concerned with their environmental, emotional, sociological, and physical preferences and the way(s) in which they believe they behave in certain situations" (p. 52).

Barbe, Swassing, and Milone (1979) discuss learning styles in similar yet more confined terms. They focus on perception, more specifically modalities (i.e., the channels through which perception occurs). These include vision, audition, and kinesthesia. They explain that "modality strengths" are those channels most efficient for processing information. These authors are interested in measuring something similar to that measured by the "perceptual strengths" section of the Dunn, Dunn, and Price Learning Style Inventory. They believe, however, that since the LSI is a self-report instrument, it most likely measures modality preferences rather than modality strengths.[7] Therefore, they developed the Swassing-Barbe Modality Index, a matching-to-sample task which provides an identification of the relative strength of each of a learner's three modalities. With knowledge of learners' and teachers' modality strengths, they suggest that instruction can be usefully monitored and modified to the benefit of each student.

Though not included in the LSI, Dunn, Dunn, and Price (1979) acknowledge one other dimension of the learning process, that is, cognitive style. They describe cognitive style as the "ways in which responses are made because of individual psychological differences" (pp. 53-54) and suggest that this may be one other subcategory of learning style.

In fact, other models of learning style focus primarily

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[7]Dunn and Carbo (1981) counter that the LSI incorporates a Consistency Score which indicates how accurately an individual has answered its questions. Moreover, they note that Ohio State University's National Center for Research in Vocational Education found the LSI to exhibit impressive reliability and face and construct validity. They further indicate that many studies have concluded that increased academic achievement has occurred due to teaching students through their identified perceptual <u>preferences</u>.

on this cognitive component. One of these models has its roots in Jung's theory of psychological types. Lawrence (1982) explains that Jung classified all conscious mental activity into four mental processes: two perception processes (sensing and intuition) and two judgment processes (thinking and feeling). Each pair is composed of polar opposites. "Everyone uses all four processes, but we differ in how much and how well we use each of them" (p. 12). One process becomes dominant (i.e., the core of the personality) and an auxiliary process is formed in the dimension that the dominant is not. Arranging the four processes into dominant and auxiliary results in eight combinations. The third dimension of Jung's personality structure is extraversion-introversion. Jung found that the four processes are expressed differently depending upon whether a person has introverted or extraverted preferences. Adding this dimension to the previous eight types creates sixteen possible personality styles.

> [Jung] believed that we are each born with a tendency toward a particular pattern and that change in human behavior, while possible, is a very slow process. He believed that growth and maturity allow us to develop our own strengths and also to understand other approaches to life. (Guild & Garger, 1985, p. 20)

Briggs and Myers elaborated Jung's psychological type theory to include a fourth dimension: namely, the attitude taken toward the outer world. This refers to whether a judgment process or a perception process is used to run one's outer life. The Myers-Briggs Type Indicator (MBTI) was developed as a self-report instrument to assess an individual's orientation toward the Jungian types. Lawrence (1982) promotes the use of these types in planning school instruction, especially with regard to motivating students. He insists that the 16 types are not evenly distributed in the school population and that "it is hard to estimate the distributions of types in the general population, since different occupations, and different educational levels, have their own characteristically different type distributions" (p. 39).

Anthony F. Gregorc: The Gregorc Style Delineator (GSD)

Another model which focuses on the cognitive aspect is that of Gregorc. According to his phenomenological perspective, "learning style consists of behaviors which give clues as to the mind-qualities an individual uses to interact with his [/her] environment and to gather and process data from it" (Gregorc, 1979, p. 25). He asserts that people learn both through concrete experiences and through abstraction and that both of these perception modes have two subdivisions, sequential and random processing. These two sets of dualities merge to form four distinct learning patterns: concrete sequential (CS), concrete random (CR), abstract sequential (AS), and abstract random (AR). (Brief descriptions of these four types can be found in Gregorc, 1979, pp. 20-22; extensive descriptions may be found in Gregorc, 1982, pp. 19-39.)

Again, while everyone exhibits all four patterns to some degree, most people have natural predispositions toward one or two.

Even though learning styles, according to Gregorc (1979), emerge from inborn proclivities, "individuals can learn certain stylistic behaviors and add them synthetically to their repertoire" (p. 22). For instance, a "natural" CR-oriented learner may find him/herself in an environment requiring CS abilities. It is possible for the individual to "learn" the CS behaviors and skills only in terms of his/her limited CS capacity and willingness to work at practicing the behaviors. The person will not be as smooth or efficient as a natural CS-oriented learner. The "deeper implication" of this finding, Gregorc suggests, "is that any given environment may make comfortable demands upon the mind-qualities of one person while placing frustrating and painful burdens upon another" (p. 22).

Within the educational setting, teacher behaviors and media use place demands on learners to align their mind-qualities accordingly. Gregorc (1979) reports,

> We have found, for example, that concrete/sequential (CS)-oriented learners report preferences for workbooks, manuals, demonstration teaching, programmed instruction, hands-on materials, and well-organized field trips. The abstract/random (AR)-oriented learner shows a predilection for movies, group discussions, short lectures accompanied by question/answers and discussion, and television. The abstract/sequential (AS) learner feels the need for extensive reading assignments, substantive lectures, audio tapes, and analytical "think-sessions." Finally, concrete/random (CR) learners like

> games and simulations, independent study projects, problem-solving activities, and optional reading assignments. (p. 23)

<u>David A. Kolb: The Learning Style Inventory (LSI)</u>

A perspective resembling Gregorc's is that of Kolb. His learning style model was developed from his theory of experiential learning. He describes learning as a four-stage cycle approximating a helix:

> Learners have immediate <u>concrete experience</u>, involving themselves fully in it and then reflecting on the experience from different perspectives. From these <u>reflective observations</u>, they engage in <u>abstract conceptualization</u>, creating generalizations or principles that integrate their observations into sound theories. Finally, learners use these generalizations or theories as guides to further action, <u>active experimentation</u>, testing what they have learned in new, more complex situations. The result is another concrete experience, but this time at a more complex level. (Claxton & Murrell, 1987, pp. 25-26)

Within this model Kolb distinguishes two fundamental dimensions in the learning process, each representing two dialectically opposed adaptive orientations. The first is "prehension," that is, grasping the experience or taking in information. Some people experience or take in information concretely, while others perceive or take in experience abstractly. The second dimension is that of "transformation," in other words, processing or transforming the experience. Some people process what they take in by internal reflection, while others transform experience through active manipulation of the external world.

Kolb (1976) explains that

> as a result of our hereditary equipment, our particular past life experience, and the demands of our present environment, most people develop learning styles that emphasize some learning abilities over others. Through socialization experiences in family, school and work we come to resolve the conflicts between being active and reflective and between being immediate and analytical in characteristic ways. (p. 4)

Hence, he developed the Learning Style Inventory, a self-description questionnaire, to assess individual orientations toward learning.

> The LSI measures a person's relative emphasis on each of the four modes of the learning process--concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE)--plus two combination scores that indicate the extent to which the person emphasizes abstractness over concreteness (AC-CE) and the extent to which the person emphasizes action over reflection (AE-RO). (Kolb, 1984, p. 68)

The juxtaposition of the two dimensions of perceiving and processing results in four different learning styles: (1) "divergers" grasp the experience through concrete experience and transform it through reflective observation; (2) "assimilators" grasp the experience through abstract conceptualization and transform it through reflective observation; (3) "convergers" grasp the experience through abstract conceptualization and transform it through active experimentation; and (4) "accommodators" grasp the experience through concrete experience and transform it through active experimentation.

Kolb (1976) reports the correlations between the Learning Style Inventory scores for Harvard MBAs and their ratings of situations that facilitate their learning:

> Concrete individuals tend to find theoretical readings unhelpful and student feedback helpful. Reflective observers find that lectures facilitate their learning. Abstract persons learn best from case studies, theoretical reading, and thinking alone, while they find exercises and simulations and talks by expert practitioners unhelpful. Active experimenters learn best from projects, homework, small group discussions, and student feedback. Lectures are not helpful to them. (p. 32)

Relating Kolb's learning styles to the instructional preferences of family practice physicians, Whitney and Caplan (1978) found that "physicians who were active learners preferred to use audiotapes as a method of continuing their education, when contrasted with physicians who were reflective learners" (p. 685). These authors suggest that "this medium would seem more appealing to the active learner and less suited to the reflective learner" because "an audiotape is a paced, nonvisual method of receiving information; to pause and reflect on the content of an audiotape requires an overt action" (p. 685). Moreover, they found that "the reflective learners, perhaps because they are less concerned with the practical application of ideas, did not hold extreme opinions about colleague group activities" (p. 685). However, "the concrete active learner (accommodator) least preferred this method, and the abstract active learner (converger) preferred it the most" (p. 685). They explain these findings as follows:

> When colleagues gather in groups, many points of view are expressed. The converger might enjoy both the abstract discussion and the synthesis of ideas necessary to actively apply new information. The more concrete learner also seeks new information to apply in daily practice but may not appreciate the seeming meanderings of a group discussion. (p. 685)

Kolb (1984) also reports research suggesting that one's learning style may be shaped by one's psychological type (i.e., Jungian psychological type as measured by the Myers-Briggs Type Indicator), educational specialization, professional career, current job, and adaptive competencies. He further maintains that one's learning style not only affects how one learns in the limited educational sense, but also in the broader aspects of adaptation to life, such as decision-making, problem-solving, and general life-style.

It must be noted, however, that while Kolb's theory of experiential learning has met with general support, questions have been raised as to the reliability and validity of the original LSI instrument (Fox, 1984; Freedman & Stumpf, 1978; Geller, 1979; Merritt & Marshall, 1984; West, 1982) as well as the 1985 revised form (Ruble & Stout, 1990, 1991; Sims, Veres, Watson, & Buckner, 1986; Veres, Sims, & Locklear, 1991).

Bernice McCarthy: The 4MAT System

Focusing on Kolb's four-quadrant model of learning styles and integrating the work of other learning style researchers led McCarthy (1987) to the development of the 4MAT System.

She describes four types of learners similar to those of Kolb. In addition, she subscribes to his idea of the cyclical sequence of the learning process moving from experience to reflection to conceptualization to experimentation and back to experience. Her 4MAT System prescribes teaching in all four of these ways so that all students will be comfortable and successful part of the time while being stretched to develop other learning abilities.

Upon this model she superimposed research regarding brain hemisphericity, which demonstrates that right mode processing is related to concrete experience and left mode processing to abstract conceptualization. She found that there was a strong tendency toward left mode in Kolb's assimilators and convergers and a strong tendency toward right mode in Kolb's divergers and accommodators. Consequently, she further urges that each of the four learning styles be taught with both right- and left-mode processing techniques. The major goal of education, according to McCarthy (1987), should be "the development and integration of all four styles of learning and the development and integration of both right- and left-mode processing skills." Thereby, "students will come to accept their strengths and learn to capitalize on them, while developing a healthy respect for the uniqueness of others, and furthering their ability to learn in alternative modes without the pressure of 'being wrong'" (p. 90).

Matching Instruction to Style

Kolb and McCarthy believe that all learners should be taught using techniques appropriate to each of the four learning styles, in part due to their view of the cyclical process of learning and to their belief that the goal of education should be the personal development of the individual. What is the opinion of other learning style researchers? A debate exists as to whether it is beneficial to "match" instruction to the student's learning style.

To this debate, Dunn, Beaudry, and Klavas (1989) retort, "Those who suggest that children should learn to adapt to their teachers' styles disregard the biological nature of style" (p. 56). Dunn (1990) notes that three-fifths of learning style is biologically imposed. Consequently, "learning styles are not lightly held; they demonstrate remarkable resistance to change" (Dunn, Beaudry, & Klavas, 1989, p. 56). As evidence for their stance, these authors report the results of eight studies which revealed that when students (kindergartners through tenth graders) "were taught with instructional resources that both matched and mismatched their preferred modalities, they achieved statistically higher test scores in modality-matched, rather than mismatched, treatments" (Dunn, Beaudry, & Klavas, 1989, p. 52).

Cotterell (1982) reviewed 35 studies which involved matching environments to learners. The studies were grouped according to their outcome measures - affective, behavioral, and achievement. "Empirical support for the matching principle was found for all three outcomes, but varied from strong support for affective and behavioral criteria to moderate support for achievement" (p. 106). Moreover, Cornett (1983) notes that "there is strong support for matching as many cognitive, affective, and physiological teacher and student style variables as possible, if the goal is to improve student attitudes and feelings of comfort with learning" (p. 40). These matches, she explains, have been found to increase satisfaction and mutual regard among teachers and learners.

So, although style matching may have produced inconsistent achievement outcomes, it can be strongly supported for affective reasons. Cornett (1983) posits that "the success of style matching in affecting attitude, attention, motivation, and general comfort can be accounted for by realizing that matching makes life easier" (p. 41). As Jenkins (1988) illustrates,

> If the learning environment does not offer appropriate alternatives..., then students are forced to make the best of a less than efficacious situation. The energy they use to make adjustments may subtract from the energy available for learning. The less energy students must bring to bear on the demands of the learning environment, the more energy they will have available for learning successfully. (p. 41)

Relevance of Learning Style Theory to Informal Education

How might this discussion of learning styles pertain to an audience of zoo visitors? These researchers invariably explain that each person deals with the concrete and the abstract, the active and the reflective in varying degrees. McCarthy (1987) asserts that "people are attracted to different kinds of employment and different disciplines of study based on the structure of those disciplines and the type of work they enjoy" (p. 64). Kolb, in fact, has conducted a variety of studies to test the relationship between individual learning styles and the types of careers people choose. His findings indicate the following:

> People choose fields that are consistent with their learning styles and are further shaped to fit the learning norms of their field once they are in it. When there is a mismatch between the field's learning norms and the individual's learning style, people will either change or leave the field. (Wolfe & Kolb, 1979, p. 553)

Recall that in a similar manner people choose leisure activities based to some degree on their personality needs (Allen, 1982). Moreover, Kolb (1976) suggests that Learning Style Inventory (LSI) scores "show sufficient variability across different populations to be useful in assessing the learning styles that characterize occupations and groups other than managers" (p. 23). Hence, it is reasonable to assume that the zoo audience may demonstrate a specific distribution of learning styles.

The literature seems to suggest that learning style is not a concept meant to apply solely in the classroom. Rather, learning styles are deeply rooted in one's biological inheritance, personality traits, past life experiences, socialization, and present environment. They undoubtedly affect aspects of life outside of formal education. They are a way of approaching life's experiences, as well as an influence in choosing those experiences. Because learning occurs over the life course and in a variety of realms, the issue of learning styles may hold promise in the informal learning sphere as well. Miles (1988, p. 166), in fact, posits that different learning styles might be expected to "divide visitors."

Regarding leisure learning, the answer to the style matching debate is more straightforward. In order to promote informal education in the zoo environment, efforts at learning must be convenient for the visitors. In formal education settings, matching instructional methods to learners' styles has been shown not only to ease the learning process but also to foster good attitudes. Hence, if learning styles are found to be applicable to a recreational environment, the appropriate strategy to encourage learning would be to match exhibit presentation to the visitors' learning styles.

In a unique application of learning styles assessment to the preferences of museum visitors, Schroeder (1991), in fact, found that when museum exhibit labels matched the learning style of the visitors, learners performed significantly better on an objective test of facts about the exhibits. In addition, he suggests that matching may expedite information processing since some visitors who had access to matched conditions spent less time with the exhibits. His study is encouraging with regard to the potential usefulness of learning styles assessment to the informal education environment.

However, Schroeder (1991) used the Myers-Briggs Type Indicator (MBTI) to classify visitors. Although he used the shortest form (Form AV), this instrument still involved 50 items. Moreover, individuals with small children were not included in his sample. Neither of these conditions is ideal, if acceptable, for the zoo setting: A lengthy time commitment cannot be requested of casual zoo visitors precisely because a large proportion of the general audience consists of individuals with young children. As learning styles assessment seems to hold promise for the leisure setting, a more practical tool needs to be found to classify visitors.

Directions Suggested by the Literature: Implications for the Present Study

Toward the goal of developing educationally effective interpretive programming for a zoological park setting, the literature of a variety of fields was perused. Extracted from this review, the following highlights sketch the foundational framework for the present study:

A Target Audience

First and foremost, in order for any communication effort to be successful, an understanding of the recipient of the message is necessary. In terms of the zoo environment, this translates into the notion that knowledge of visitor characteristics is essential. More specifically, to design an effective display, the target audience of the exhibit must be distinguished from the total audience. The present study's objective, therefore, was to establish a useful typology of zoo visitors. As the ultimate goal was to promote informal learning, this typology would be based on educational criteria.

Zoo Visitors' Learning Styles

In the formal education literature, learning styles have been found to depend on heredity as well as socialization. Different personalities, occupations, and educational backgrounds and levels have their own characteristically different type distributions. More importantly, research suggests that people learn most easily when information is presented in accordance with their personal learning style. That is, matching learning style to instructional technique promotes positive attitudes, feelings of comfort, and increased achievement.

In a formal education setting, students may be expected to attempt to learn in a variety of styles. In a leisure environment however, participants cannot be expected to put forth the added effort. They will learn only if it is convenient for them. Catering to different learning styles could be the key to merging education with recreation and accomplishing the zoo's educational goals. Hence, zoo visitors would be classified according to learning style.

The question remained, however, as to which learning style assessment instrument would be appropriate for a recreational setting:

(A) The Dunn, Dunn, and Price learning style instruments are quite extensive, including scales inapplicable to a leisure environment.

(B) Because more than just modality strength is at issue, the Swassing-Barbe Modality Index is not suitable.

(C) The administration of the Myers-Briggs Type Indicator (MBTI) appears to require a time commitment unacceptable for leisure learners at a zoo.

(D) Two instruments which are of an acceptable administration length are the Gregorc Style Delineator (GSD) and David Kolb's Learning Style Inventory (LSI). Though previously untested in an informal education environment, these two tools seemed to be appropriate candidates. As such, they would be employed on an alternating basis among all subsamples of the present study to assess the utility of each for the development of zoo exhibits.

Social Nature of the Zoo Visit

The significance of the social nature of a museum visit has been well-documented. Therefore, although it could be important to identify the learning style of individuals, it would be imperative to recognize the social context within which they were operating. Consequently, information as to the composition of visitor groups, as well as the visitors' interactions with companions and with exhibit components would be examined.

The Purpose of the Present Study

From the foregoing structure emerged the immediate purpose of the present study: to examine whether the formal education concept of learning styles could be generalized to a leisure environment.

CHAPTER II:

METHOD

Research Objectives

In its most basic terms, this research sought to determine whether Kolb's or Gregorc's four learning styles could be distinguished among zoo visitors. It further strove to explore the relationship of these styles to exhibit-type preferences and to the social context of a zoo visit. It also attempted to characterize a target group (i.e., prospective Congo Forest visitors) from among the total Bronx Zoo/Wildlife Conservation Park audience. The study's fundamental purpose was to suggest whether the learning style concept, as it now exists for formal education, is useful to the zoo setting, given the social and recreational nature of this leisure pursuit.

The research involved three phases:

Phase I characterized the general zoo audience.

Phase II sought to characterize the visitors attracted by a Congo Forest promotional sign.

Phase III tested for whether relationships exist between a visitor's learning style and the characteristics of interpretives.

Phase I

Phase I was undertaken primarily to characterize the general zoo audience according to learning style.

It sought answers to the following questions:

1. Do Kolb's (1985) four different learning styles characterize zoo visitors, and if so, in what proportions?
2. Do Gregorc's (1982) four different learning styles characterize zoo visitors, and if so, in what proportions?
3. Do demographic/social variables (sex, age, educational level, Bronx Zoo/Wildlife Conservation Society membership, group composition, decision-making process within visiting group) and/or frequency of zoo visits relate to learning style?
4. Does learning style relate to one's expressed preferences for the verbal descriptions of different exhibit types?

PROCEDURE FOR PHASE I

I. The researcher elicited participation from among the adult visitors seated in three Bronx Zoo/Wildlife Conservation Park locations. A systematically selected sample of visitors was offered a free animal key chain as an incentive to participate. (See Appendix A.)

II. The visitors who agreed to participate were given a questionnaire to complete.

III. Surveys were quantified, learning style instruments were scored, and statistical analyses were performed.

SAMPLING PROCEDURE FOR PHASE I

The researcher recruited participants by collecting a systematic sample of adult visitors from among each of the following: (1) the visitors seated in the Lakeside Cafe, (2) the visitors seated in the Zoo Terrace, and (3) the visitors sitting on benches in Astor Court near the sea lion pool. These three locations were chosen so as not to inconvenience the visitors. The respondents were able to maintain their activity, be it resting or finishing lunch, while engaged with the survey. More importantly, the other members of the group remained occupied during the brief encounter.

The systematic sampling procedure used in each of the three locations was as follows:

(1) Visitors seated in the Lakeside Cafe: The researcher divided the area into seven subsections. She began by observing one section (each data collection period beginning with a different section). She approached the first "complete" group to sit down in this section, if it included at least one adult. (That is, if part of the group was seated awaiting another member who was bringing the food, the researcher would not approach until the entire group appeared to be intact.) Within each group she then asked the adult second from her left (unless, of course, there was only one adult) to participate. (This was merely an arbitrary procedure to reduce the possibility of selection bias.) Once this interview was completed, the researcher proceeded in a

counterclockwise direction to the next subsection and repeated the procedure. If no new group arrived in a section within three minutes, the researcher proceeded to the next section. On days with slow visitor traffic, the researcher would approach every third group to seat themselves in the cafe, regardless of the subsection in which they sat.

(2) Visitors seated in the Zoo Terrace: The researcher stationed herself next to a vacant pretzel cart near the concession stand windows in order to have a clear vantage point of the entire northern clump of tables. She approached every third complete group to seat themselves in the Zoo Terrace. Within each group she asked the adult second from her left to participate. If the visitor agreed, the researcher would leave the survey at the table and return to her station. Upon completing the survey, the participant would signal to the researcher, who would reappear to collect it, answer any questions, and thank the visitor with a key chain. Afterwards the researcher again stationed herself to await the next third complete group to be seated.

(3) Visitors seated in Astor Court: The court was divided into two sections: the east and the west. The east side consists of seven bench clusters and the west side six. The researcher observed each side from a designated post. On the east, the researcher stationed herself either near the Education building or on a bench near the Monkey House; on the west, she was posted at the bottom of the ramp to the

administration building. She approached the first group to sit down in the observed section, if it included at least one adult. Within each group she asked the adult second from her left (unless there was only one adult) to participate. While the respondent was completing the survey, the researcher sat on a nearby bench. Once this interview was completed, the researcher returned to the designated post and awaited the next group to sit down anywhere on that side of the court.

The sample was collected between June 6, 1994 and August 8, 1994. Sampling occurred on both weekdays and weekends at each of the locations. Sampling did not occur on Wednesday, the day admission to the zoo is free, because the audience appears to be distinctly different from the general paying crowd. The Lakeside Cafe and the Zoo Terrace were busiest around "lunch time," so sampling occurred between 11:30 am - 2:15 pm and 11:30 am - 3:30 pm respectively. Visitors were most likely to be sitting in Astor Court resting during the afternoon, so sampling occurred between 1:00 pm - 5:00 pm. The final sample of the General Zoo Audience consists of 100 surveys, collected in equal proportions from the different locations (see Table 1).

Table 1
Sampling Locations for the General Zoo Audience (Phase I)

Location	No. of LSI[a]	No. of GSD[b]	Total
Lakeside Cafe	17	16	33
Zoo Terrace	16	17	33
Astor Court - East	9	8	17
Astor Court - West	8	9	17
Total	50	50	100

[a]Kolb's Learning Style Inventories. [b]Gregorc Style Delineators.

THE PARTICIPANTS IN PHASE I

Surveys were collected by systematically sampling male and female adult visitors (18 years or older) at three park locations. Upon being asked to complete the anonymous survey, a portion of the visitors declined. Of the surveys collected, some were deemed unusable and replacements were gathered.

The following list delineates the reasons why certain visitors or surveys were excluded from the sample. The specific numbers of cases associated with each of these reasons may be found in Table 2.

Table 2
Frequencies of Excluded Cases and Final Samples for Phase I and Phase II

	Phase I	Phase II
A. Ineligibility		
1. Difficulty with English		
a. Visitor declined	13	1
b. Questionable validity	1[a]	1[a]
2. Not a "voluntary" visitor	1	0
3. Researcher not present to provide instructions and explanations for learning style instrument	0	1
B. Refusal Rate	21%	17%
1. Systematically selected eligible visitors	139	121
2. Refusals to participate	29	20
C. Unusable Surveys		
1. Incorrectly completed learning style instrument	6[a]	0
2. Incomplete surveys	4	1
D. Final Sample	100	102
1. Number of LSIs[b]	**50**	**51**
a. Collected on weekdays	25	23
b. Collected on weekends/holidays	25	28[c]
2. Number of GSDs[a]	**50**	**51**
a. Collected on weekdays	25	26
b. Collected on weekends/holidays	25	25[d]

[a]Gregorc Style Delineator (GSD). [b]Learning Style Inventory. [c]This collection includes five surveys gathered on Labor Day (a Monday holiday). [d]This group includes four surveys collected on Labor Day.

<u>Ineligibility</u>

Visitors and surveys were ineligible for inclusion in the sample for one of the following reasons.

(1) The visitor had difficulty understanding English.

(a) There was only an English version of the survey. Upon being asked, some visitors declined to participate due to their difficulty with the English language.

(b) One goal of this study was to characterize groups of zoo visitors according to their learning style. The validity of the learning style assessment is dependent upon the respondent's comprehension of the words used by the learning style instrument. Hence, if a non-native English-speaking visitor appeared to have difficulty understanding the words used by the instrument (e.g., he or she was observed receiving guidance from a companion), the survey was deemed ineligible for inclusion.

(2) Participants must be attending the zoo as "voluntary" visitors. Accordingly, the survey of a bus driver was ineligible for inclusion in the sample.

Unusable Surveys

There were two reasons that surveys were considered unusable.

(1) Because one goal of this study was to characterize groups of zoo visitors according to their learning style, if the learning style assessment instrument was not completed correctly, the survey was deemed unusable.

(2) Surveys which were missing data were omitted from the sample.

INSTRUMENTS USED IN PHASE I

I. The questionnaire included questions regarding demographic information (see Appendix B), the respondent's preference for different exhibit types, the composition of the visiting group (see Appendix C), the decision-making procedure the group follows while at the Zoo, and the participant's willingness to pay either for the proposed Congo Forest experience (see Appendix D) or the Rare Bird Conservation Hub experience (see Appendix E).

II. The written survey also included, as an alternating second page, either Kolb's (1985) Learning Style Inventory (LSI) or the Gregorc Style Delineator (GSD; see Appendix F).

Phase II

Phase II was conducted to characterize the audience attracted to the Congo Forest Conservation Trail.

It sought answers to the following questions:

1. What are the predominant learning styles among the visitors attracted by the Congo Forest sign?
2. How does the group attracted compare to the general zoo audience?

PROCEDURE FOR PHASE II

I. A large sign was posted near the Gorilla exhibit. It showed a photograph of a gorilla with the text: Congo Rain Forest Conservation Trail $2.00.[8] An arrow on the sign pointed toward a bend in the path. At this bend was located a round picnic table. The researcher was stationed at this table with the following: the designers' portfolio of artistic renderings of the proposed Congo Forest exhibit, clipboards with various visitor suggestion forms, the visitor surveys, and a sign explaining this arrangement. The sign at the table read:

> Sorry--the new gorilla exhibit has not been constructed yet. We'd like you to be part of the design process. Help us create the world's best gorilla exhibit by giving us your suggestions.

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[8]Initially the sign advertised $3.00. In an attempt to increase the frequency of visitor inquiries, the price was lowered to $2.00. Ten surveys had been collected under the original condition. Because these respondents did not differ significantly in background data compared to the subsequent participants, their surveys were retained in the final sample.

II. Every visitor group to approach the table inquiring about the "Rain Forest Conservation Trail" was given an explanation, asked to participate, and offered their choice of a gorilla key chain or a big cats poster for completing the survey. (See Appendix G.)

III. The visitors who agreed to participate were given a questionnaire. Upon completing it, they were thanked and given their free "gift."

IV. Surveys were quantified, learning style instruments were scored, and statistical analyses were performed.

SAMPLING PROCEDURE FOR PHASE II

Casual zoo visitors were attracted to the survey site by a Congo Rain Forest Conservation Trail promotional sign. Upon arriving at the survey site, visitors encountered a sign explaining what was actually happening. In addition, every group to arrive was greeted by the researcher. (A group may consist of any number of members, including singletons.) In this group, the second adult from the researcher's left (this is merely an arbitrary procedure to reduce the possibility of selection bias) was asked to participate. (See Appendix G.)

The sample was collected between August 12, 1994 and September 17, 1994. Sampling occurred on both weekdays (except Wednesdays, the free admission days) and weekends between 10:30 am - 5:00 pm.

THE PARTICIPANTS IN PHASE II

Male and female adult visitors (18 years or older) who arrived at the survey site inquiring about the "Congo Rain Forest Conservation Trail" were asked to participate. As in Phase I, certain visitors and surveys were excluded from the sample (refer to Table 2).

In addition to the reasons defined in Phase I, there was one circumstance unique to Phase II. At certain times when the researcher was away from the Congo Forest display, a zoo volunteer was stationed there. The volunteer was instructed to ask any interested visitors who approached to complete one of the brief surveys (e.g., regarding perceptions of gorillas or naming the new exhibit) but not to offer the more lengthy survey which included the learning style instrument (and is the subject of this report). Nonetheless, one such survey was completed in the researcher's absence. In this case, the appropriate instructions for the learning style assessment instrument and any necessary explanations were not given to the respondent. Hence, this survey was considered ineligible and eliminated from the sample.

INSTRUMENTS USED IN PHASE II

The instruments used in Phase II were identical to those used in Phase I (see Appendixes B-F).

Phase III

Phase III was conducted to investigate whether learning styles is a useful category for classifying informal learners in leisure environments or whether the social context overshadows the importance of this individualistic trait.

It sought answers to the following questions:

1. Does one's learning style relate to one's interactions with exhibit components and/or other individuals when visiting in a group?
2. Does one's learning style relate to one's assessment of interpretives?
3. Do demographic/social variables (such as gender or group composition) relate to one's interactions or one's assessment of the interpretives?

Phase III was divided into two parts: Part B and Part H, each examining a different set of interpretives.

Part B investigated one viewing bay located in the Baboon Reserve which includes question and answer lift panels, a touchable replica of ibex horns, two telescopes, and factual graphics (see Appendix H for complete documentation of the interpretives).

Part H explored the interpretives located in an alcove in the Himalayan Highlands which consists of factual, narrative, and quotation text about conservation, a touchable radio collar, and participatory rotating panels (see Appendix I).

PROCEDURE FOR PHASE III

I. Of the casual visitors arriving at the test site (in either the Baboon Reserve or the Himalayan Highlands), a systematic sample was asked to participate and offered a free animal key chain as an incentive. The selected individuals who agreed completed a survey regarding demographic information while still at the entrance.[9]

II. Even though all casual visitors were welcome to view the display, the researcher observed only the selected adult member in relation to his/her group. She recorded social interactions, interactions with exhibit components, and learning-related behaviors which the individual displayed at the exhibit.

III. After being observed at the exhibit, the selected adult member was asked to complete a learning style assessment instrument and a questionnaire concerning his/her understanding of, preference for, and reactions to the interpretives. (See Appendix J for the entire interview protocol.)

IV. Observations and forced-choice questionnaire items

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[9]Initially participants were also asked to complete the learning style instrument while at the entrance. Because this instrument takes approximately four minutes to complete, other group members tended to proceed ahead. In an attempt to maintain group cohesiveness, the procedure was altered to require minimal time before reaching the exhibit. Seven Baboon Reserve surveys and fifteen Himalayan Highlands surveys were completed according to the original procedure. However, as they showed no differences compared to the surveys collected by the revised procedure, they were retained in the final sample.

were quantified, open-ended survey items were content-analyzed, the learning style instruments were scored, and statistical analyses were performed.

SAMPLING PROCEDURE FOR PHASE III

Casual zoo visitors were recruited by using a systematic sampling procedure. Every third group to arrive at the test site was greeted by the researcher. In this group, the second adult from the researcher's left was asked to participate (this is merely an arbitrary procedure to reduce the possibility of selection bias). After the selected individual completed a brief demographic survey at the entrance, the group was led to the designated alcove and the researcher stationed herself inconspicuously nearby. She unobtrusively observed the respondent, recording the relevant data.
After the observed visitor finished with the interpretives, the researcher led him/her to a site further down the path. At this distant location, from which the interpretives were no longer visible, the respondent completed the remainder of the survey. During this time, other group members occupied themselves by viewing the nearby displays. After thanking the group for its participation and offering a key chain, the researcher returned to the entrance and selected a member from the next third group to participate.

THE PARTICIPANTS IN PHASE III

The Baboon Reserve sample was collected between July 1, 1994 and August 14, 1994. The Himalayan Highlands sample was collected between June 30, 1994 and August 7, 1994. Sampling occurred on both weekdays (except Wednesdays, the free admission days) and weekends between 11:00 am - 4:30 pm. All male and female adult visitors (18 years or older) entering either the Baboon Reserve or the Himalayan Highlands were eligible for selection.

A process similar to those applied in Phases I and II was used to assemble a sample of surveys for the Baboon Reserve and for the Himalayan Highlands. First, a systematic sample of visitors was asked to complete the anonymous survey. At this point a portion of the visitors declined. Of the surveys collected, a few were immediately deemed unusable and replacements were gathered.

Because one goal of this study was to examine how the different learning styles relate to the different exhibit components, surveys characterized by lack of responses were also excluded from the sample and replaced. Hence, if the visitor did not attend to the components or did not provide a sufficient number of responses, his/her survey could not be useful toward the study's purpose and was excluded from the sample. The specific criteria used to exclude surveys from the Baboon Reserve and Himalayan Highlands samples are recorded below.

Survey Exclusion Criteria for the Baboon Reserve and the Himalayan Highlands

(1) The visitor was not observed looking at more than one component of the display, excluding the live animals.

The survey asks for a rating of the five different exhibit components. If a visitor only looked at one, how could an opinion be given for each of the five?

(2) The visitor rated four or more of the five exhibit components with a "0."

A rating of "0" meant "I did not look at it."

(3) The visitor rated three exhibit components with a "0" and provided other ratings which did not correspond with the researcher's observations.

(4) The visitor gave no differentiating responses to the rating scale items (e.g., all 6's), and no answers to the open-ended recall questions, and reason to suggest a lack of interest in the initial opinion inquiries (e.g., "I didn't pay too much attention").

(5) The visitor did not spend at least 20 seconds in the area and indicated disinterest in spending more time (e.g., "I didn't spend time to read it I really come to the zoo to see the animals").

(6) The researcher had reason to believe that the visitor did not spend the amount of time she or he would have preferred due to extenuating circumstances.

Examples of these extenuating circumstances include one visitor who got too hot to stay in the Baboon viewing enclosure, one visitor whose crying daughter prompted them to leave the exhibit, and one visitor who arrived at the zoo late and was in a hurry.

(7) The researcher had reason to believe that the validity of the survey was questionable.

In this one instance, the visitor demonstrated a lack of attention to the exhibit and afterwards explained that she did not read anything so she could not answer any of the open-ended recall questions. Moreover, the one answer she did give regarding what she learned came from the researcher's conversation with her companion and not from the exhibit itself.

The number of cases represented by each criterion may be found in Table 3.

The final samples from the Baboon Reserve and the Himalayan Highlands consist of 110 and 115 surveys respectively. These samples represent "users" of the exhibits, not simply arbitrarily chosen participants.

Table 3

Frequencies of Excluded Cases and Final Samples for the Baboon Reserve (BR) and the Himalayan Highlands (HH)

	BR	HH
A. Ineligibility[a]	(19)	(20)
1. Difficulty with English		
a. Visitor declined	19	12
b. Questionable validity	0	4[b]
2. Inability to see clearly	0	4[c]
B. Refusal Rate	19%	23%
1. Systematically selected eligible visitors	150	166
2. Refusals to participate	28	39
C. Unusable Surveys due to missing data	1	2
D. Excluded Surveys[d]	(11)	(10)
1. Visitor did not look at more than one exhibit component	2	2
2. Four or more of the five components were rated "0"	2	3
3. Three components were rated "0" and other ratings did not correspond to observations	3	0
4. No differentiated ratings, no answers, and lack of interest	0	2
5. Visitor did not spend at least 20 seconds in the exhibit area	0	2
6. Extenuating circumstances prompted visitor to leave exhibit	4	0
7. Questionable validity (not due to language)	0	1
E. Final Sample	110	115
1. Number of LSI	**55**	**57**
a. Collected on weekdays	29	24
b. Collected on weekends/holidays	26	33[e]
2. Number of GSD	**55**	**58**
a. Collected on weekdays	28	28
b. Collected on weekends/holidays	27	30[f]

[a]For more explicit explanations see The Participants in Phase I section. [b]Two LSIs and two GSDs. [c]This group includes visitors who were unable to read due to either cataracts or wearing sunglasses rather than their prescription eyeglasses. [d]For more explicit descriptions see text The Participants in Phase III. [e]This group includes four surveys collected on the Fourth of July (a Monday holiday). [f]This group includes two surveys gathered on the Fourth of July.

INSTRUMENTS USED IN PHASE III

I. The initial written survey gathered demographic and group composition information. (See Appendix K.)

II. The data collection sheet used to record observations at the interpretives included categories of social interaction, interactions with exhibit components, and learning-related behaviors. (See Appendix L for the Baboon Reserve form and Appendix M for the Himalayan Highlands form.) Tallies were kept of all occurrences of the pre-determined categories throughout the duration of the selected visitor's stay at the exhibit.

III. The follow-up survey included either Kolb's Learning Style Inventory (LSI) or the Gregorc Style Delineator (GSD), on an alternating basis, to identify each participant's dominant learning style (refer to Appendix F). This self-report survey also included questions regarding the participants' reactions to the interpretives and their understanding of the exhibit's content. (See Appendix N for the Baboon Reserve survey and Appendix O for the Himalayan Highlands survey.)

Hypothesized Relationships
Between Learning Styles and Exhibit Preferences

The rationale for choosing certain forms of displays to be tested was based on a synthesis of the work conducted in relation to the models of Gregorc and Kolb. Two significant sources are Butler, K. (1987) and McCarthy, B. (1987). Butler has developed an instructional system based on Gregorc's learning styles. McCarthy, similarly, has designed a teaching format employing Kolb's typology. The following relationships between learning styles and instructional techniques emerged from their work.[10]

Gregorc's Learning Styles

Butler (1987) has taken Gregorc's style types and elaborated descriptions of these individuals as learners, indicating the instructional methods by which each group learns most comfortably and effectively. Her system incorporates modalities (i.e., sensory channels through which information is received and retained) only insofar as certain ones exist as preferences of specific styles. For instance,

[10]According to the characterizations cited, exhibit preferences were hypothesized for each learning style. Given the rather ambiguous nature of some of the characteristics associated with each style, not to mention the fact that the style descriptions were developed for application in formal education environments, an admittedly liberal interpretation generated the hypotheses for the present leisure interpretives.

touch (hands-on activity) appeals most to Concrete-Sequentials and Concrete-Randoms, whereas Abstract-Randoms show a visual inclination and Abstract-Sequentials a possible penchant for the auditory.

Her "Style Differentiated Instruction" approach suggests various ways to apply style practically in the classroom. These strategies include (a) having all students do one exercise together, but using "bridging techniques" to help everyone deal successfully with the style demands of the content/activity; (b) allowing students to choose an activity from among options; and (c) rotating among the four styles (in no particular sequence), requiring all students to complete all activities.

The following characterizations of the different learning styles (but not the hypothesized exhibit preferences) are taken from Butler (1987).[11]

Gregorc's Concrete-Sequential Style

Concrete-Sequential learners have special abilities to learn about the world in an orderly and step-by-step way. They show their finest talents when learning focuses on information, detail, facts, and eventual right answers that

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[11]From Learning and Teaching Style: In Theory and Practice (pp. 135, 145, 155, 165, 224-237), by K. A. Butler, 1987, (Rev. 2nd ed.), Columbia, CT: The Learner's Dimension. Copyright 1984, 1986 by The Learner's Dimension. Adapted with permission.

are useful to their lives and way of thinking. They perform at their best using one or more of their physical senses; hence, many CS learners prefer hands-on activity. Rather than reading about a project or joining a group to discuss an idea, this style would prefer to join work on a community project.

CS instructional perspective:
factual, structured, realistic, practical, detailed, hands-on.

CS instructional preferences:
checklists, worksheets, outlines, charts, hands-on activity, maps, computer programs, demonstrations, field trips, skills, memory games, information search, drill and practice, how-to projects, practical problems, directed activity, diagramming, flowcharting, creating timelines, Venn diagrams, attribute listing, classification, realistic writing, making original structured products (e.g., dioramas, models, replicas, and graphs).

Hypothesized exhibit preferences for **Concrete-Sequentials:**

Verbal descriptions[12] - signs asking questions which must be lifted or turned for the answer, displays which include touchable items.

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[12]"Verbal descriptions" refers to those survey items describing general exhibit types which the General Audience and Conservation Trail samples were asked to rate.

Baboon Reserve - the "liftable" panels under which is printed answers or further information, the ibex horn replicas which demonstrate how to tell the age of an ibex.

Himalayan Highlands - the mounted radio tracking collar, the world map listing various conservation projects.

Gregorc's **Abstract-Sequential** Style

Abstract-Sequential learners have the special ability to learn about the world from extensive reading and working with ideas. These students exhibit their finest talents when they focus learning on ideas, intellectual discussion, and theories, and when teachers require logical analysis. AS learners would rather read about ideas and problems than work on hands-on projects, discuss feelings and viewpoints, or test solutions to problems. They give their best in classes that require content knowledge, discussions of theories, research papers, and learning from lectures. They tend to see the "big picture" and are able to provide overviews of the content.

AS instructional perspective:

reading, logical, referenced, idea-oriented, analyzing, debating.

AS instructional preferences:

lecture, text, note-taking, outlining, library work, documenting, lengthy reading, instructional media, audio tapes, writing reports and bibliographies, doing research and referencing, individualized study, logic puzzles, content mastery, conceptualizing and producing original ideas based on research (such as policy statements and critiques).

Hypothesized exhibit preferences for **Abstract-Sequentials:**

Verbal descriptions - signs telling facts about the animals, displays which provide an overview of an issue by presenting the conflicting viewpoints, exhibits including audio recordings.

Baboon Reserve - the text graphics which convey factual messages, the bulletin board.

Himalayan Highlands - the rotating panels which present the perspectives of different people regarding snow leopard conservation, the world map listing various conservation projects.

Gregorc's **Abstract-Random** Style

Abstract-Random learners have special abilities to learn about the world by working with others, in group discussions, and with material that allows them to give their impressions and feelings. These students show their finest abilities when learning focuses on themes, ideas, people, and feelings, and in situations that do not require them to follow exact rules or directions. They are at their best when personally involved with what they are learning. They would rather have a discussion about a topic than work on a project or read about it. They would rather deal with problems involving people than with more general problems. AR learners give their best in a class when the teacher emphasizes a cooperative group approach, personal interaction, and open communication between students and teachers.

AR instructional perspective:
personal, relating, feeling, interpretive, flexible, imaginative.

AR instructional preferences:
group work, visual thinking, mapping, cartoons, music, poetry, humor, media/movies/television, short reading or lecture with discussion, personalized examples, the relationship of subjects to people, group discussion, cooperative learning, role play/drama, interviewing, using metaphor, relational thinking, values clarification, keeping journals, interpretive writing or drawing, composing original interpretive products (e.g., creative writing, visual/performing arts, songwriting, social leadership, peer counseling, or aesthetic products).

Hypothesized exhibit preferences for **Abstract-Randoms:**

Verbal descriptions - displays which give an overview of an issue by presenting the conflicting points of view, displays including silent videos or photographs.

Baboon Reserve - the glass-enclosed bulletin board.

Himalayan Highlands - the rotating panels which tell the views of different people, the diary excerpts about tracking a snow leopard, the sign with the quotation from Buddhist writings.

Gregorc's Concrete-Random Style

Concrete-Random learners have special abilities to learn about the world by working with few rules, by using a problem-solving approach, and by experimenting with different ideas and products. They demonstrate their finest talents when they focus on interesting investigations, "why" questions, and discovery learning. They have extraordinary abilities to brainstorm and to suggest alternative ways of considering ideas and problems. They are real-world learners who are at their sharpest when trying out their ideas, applying what they have learned, and testing to see if something actually works. They prefer to change things rather than repeat what they have already tried. They look for different and unusual ways of learning, working, and creating.

CR instructional perspective:

divergent, investigative, experiential, open-ended, problem-solving, inventive.

CR instructional preferences:

brainstorming, divergent thinking, gathering possibilities, hands-on experience, open-ended activities, webbing, games, simulation, experiments, computer games, forecasting, finding alternatives, analogies, independent study, creating original unusual products as a result of experimentation and divergent thinking (such as inventions, innovations, and new solutions).

Hypothesized exhibit preferences for **Concrete-Randoms:**

Verbal descriptions - exhibits which allow you to try your own skills and experiment with something, displays which include touchable items.

Baboon Reserve - the telescopes, the mounted ibex horns.

Himalayan Highlands - no display seems as if it would be especially appealing to this group.

Kolb's Learning Modes

From among Kolb's work, instructional preferences have been reported in relation, not to his learning styles, but to his four learning modes (Fry, 1978; Kolb, 1976; as cited in Kolb, 1984, p. 200). The following mode descriptions are taken from Kolb (1984, pp. 68-69); the associated instructional preferences come from Kolb (1984, p. 200).[13]

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[13]From Experiential Learning: Experience as The Source of Learning and Development (pp. 68-69, 200), by D. A. Kolb, 1984, Englewood Cliffs, NJ: Prentice-Hall, Inc. Copyright 1984 by Prentice-Hall, Inc. Adapted with permission.

Kolb's Concrete Experience Mode

An orientation toward concrete experience focuses on being involved in experiences and dealing with immediate human situations in a personal way. It emphasizes feeling as opposed to thinking; a concern with the uniqueness and complexity of present reality as opposed to theories and generalizations; an intuitive, "artistic" approach as opposed to the systematic, scientific approach to problems. People with this orientation enjoy and are good at relating to others. They are often good intuitive decision makers and function well in unstructured situations. They value relating to people and being involved in real situations. They have an open-minded approach to life.

CE instructional environment.

Individuals scoring high in concrete experience indicated that their ability to learn was enhanced by affectively related factors such as personalized feedback, sharing feelings, teachers behaving as friendly helpers, activities oriented toward applying skills to real-life problems, peer feedback, and the need to be self-directed and autonomous. An environmental factor that hindered their learning ability was theoretical reading assignments.

Hypothesized exhibit preferences for **Concrete-Experiencers:**

Verbal descriptions - signs with questions which must be lifted or turned for the answers, exhibits which allow you to try your own skills and experiment with something.

Baboon Reserve - the liftable panels which provide answers/information underneath, the mounted ibex horns, the telescopes.

Himalayan Highlands - the radio tracking collar, the rotating panels telling different points of view, the diary excerpts about tracking a snow leopard.

Kolb's **Reflective Observation** Mode

An orientation toward reflective observation focuses on understanding the meaning of ideas and situations by carefully observing and impartially describing them. It emphasizes understanding as opposed to practical application; a concern with what is true or how things happen as opposed to what will work; an emphasis on reflection as opposed to action. People with this orientation enjoy intuiting the meaning of situations and ideas and are good at seeing their implications. They are good at looking at things from different perspectives and at appreciating different points of view. They like to rely on their own thoughts and feelings to form opinions. They value patience, impartiality, and considered, thoughtful judgment.

RO instructional environment.

The learners scoring highest in reflective observation reported perceptually related environmental factors as being helpful. These included teachers providing expert interpretations and guiding or limiting discussions, output being judged by external criteria of field or discipline, and lecturing. Reflective learners are not helped by task-oriented situations where information generation was focused on getting some job done.

Hypothesized exhibit preferences for **Reflective-Observers:**

Verbal descriptions - displays which provide an overview of an issue by presenting the different points of view, signs telling facts about the animals.

Baboon Reserve - the glass-enclosed bulletin board, the written messages on the signs.

Himalayan Highlands - the rotating panels which tell the views of different people regarding snow leopard conservation, the diary excerpts, the sign relating a quote from Buddhist writings, the world map listing various conservation projects.

Kolb's **Abstract Conceptualization** Mode

An orientation toward abstract conceptualization focuses on using logic, ideas, and concepts. It emphasizes thinking as opposed to feeling; a concern with building general theories as opposed to intuitively understanding unique, specific areas; a scientific as opposed to an artistic approach to problems. People with this orientation enjoy and are good at systematic planning, manipulation of abstract symbols, and quantitative analysis. They value precision, the rigor and discipline of analyzing ideas, and the aesthetic quality of a neat conceptual system.

AC instructional environment.

Learners scoring highest in abstract conceptualization cited symbolically related factors such as case studies, thinking alone, and theory readings as contributing to their ability to learn. They also felt that several elements of affectively and behaviorally oriented environments hindered this ability. These included group exercises and simulations, the need to be self-directed or autonomous, personalized feedback, teachers being models of the profession, sharing personal feelings about subject matter, dealing with "here-and-now" information, and activities oriented toward experiencing being a professional in the field.

Hypothesized exhibit preferences for **Abstract-Conceptualizers:**

Verbal descriptions - signs telling facts about the animals, displays which give an overview of an issue by presenting the conflicting points of view.

Baboon Reserve - the written messages on the signs, the bulletin board.

Himalayan Highlands - the world map listing numerous conservation projects.

Kolb's Active Experimentation Mode

An orientation toward active experimentation focuses on actively influencing people and changing situations. It emphasizes practical applications as opposed to reflective understanding; a pragmatic concern with what works as opposed to what is absolute truth; an emphasis on doing as opposed to observing. People with this orientation enjoy and are good at getting things accomplished. They are willing to take some risk in order to achieve their objectives. They value having an influence on the environment around them and like to see results.

AE instructional environment.

The learners with the strongest active-experimentation tendencies identified several factors as helpful that one would associate with a behaviorally oriented learning environment. These included small-group discussions, projects, peer feedback, homework problems, the teacher behaving as a model of the profession, being left to judge one's work by oneself, and activities designed to apply skills to practical problems. Things these students reported as hindrances to their ability to learn included lectures, teachers serving as taskmasters, and having their work evaluated as simply right or wrong.

Hypothesized exhibit preferences for **Active-Experimenters:**

Verbal descriptions - exhibits which allow you to try your own skills and experiment with something, signs asking questions which you must lift/turn for the answer.

Baboon Reserve - the telescopes, the ibex horn replicas, the lift panels.

Himalayan Highlands - no display seems especially appropriate for this group.

Kolb's Learning Styles

McCarthy (1987) synthesized the work of learning style researchers, using Kolb's model as a foundation. By adding the dimension of left/right brain processing to Kolb's basic learning styles, she developed the "4MAT" teaching system. This instructional technique relies on the "cycle of learning," that is, beginning with concrete experience and taking students through reflective observation and abstract conceptualization to active experimentation, and then back to concrete experience (at a deeper level). In contrast to Butler's program, there is a definite sequence to be followed through which each style will get its "chance to 'shine' 25% of the time" (p. 47).

Employing Kolb's Learning Style Inventory as the classifying instrument, she has elaborated descriptions of her own four learning styles. As her descriptions have been formulated specifically to be used in designing instructional methods, they are especially relevant to the present discussion of proposed relationships between learning styles and exhibit preferences. Although she explains that a well-written 4MAT lesson, by its very nature, would include modalities, she does not relate the different modalities to specific styles. The following descriptions have been taken from McCarthy (1987).[14]

Kolb's **Diverger** Style translated by McCarthy into

Type One: The Imaginative Learners

This group perceives information concretely and processes it reflectively. That is, they rely heavily on personal experience and reflection on that experience. They are concerned with personal meaning, hence, they integrate experience with the self. They learn by listening and sharing ideas. They excel in viewing direct experience from many perspectives. They value insight thinking and work for harmony. They need to be personally involved. Due to their interest in people and culture, they are thoughtful and enjoy observing others. They absorb reality and seek meaning and clarity. They check out their feelings and ideas through

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[14]From The 4MAT System: Teaching to Learning Styles with Right/Left Mode Techniques, by Excel, Inc. Used by special permission. Not to be further reproduced without the express written permission of Excel, Inc. 23385 Old Barrington Road, Barrington, IL 60010, 708-382-7272.

interaction with others. Discussion and sharing are the means by which they pull it all together. Their strength lies in creating imaginative ideas.

Appropriate instructional techniques.

Type One learners (Divergers) need reasons to proceed with learning; a desire must be created within them. They excel in the following skills: observing, questioning, visualizing, imagining, inferring, diverging, as well as in the group participation skills of brainstorming, listening, speaking, interacting, and pulling together diverse elements. The favorite method is interaction and discussion.

Hypothesized exhibit preferences for **Divergers**:

Verbal description - displays which provide an overview of an issue by presenting the conflicting points of view.

Baboon Reserve - the glass-enclosed bulletin board.

Himalayan Highlands - the rotating panels which tell the views of different people, the diary excerpts about tracking a snow leopard, the sign with the quotation from Buddhist writings.

Kolb's **Assimilator** Style translated by McCarthy into Type Two: The Analytic Learners

These learners perceive information abstractly and process it reflectively. They devise theories by integrating their observations into what is known. They form reality. They learn by thinking through ideas. They are introspective, relying on intellectual ability as a primary focus for understanding. They want to know the facts (i.e., what the body of acknowledged knowledge is) and they need to know what the experts think. They are thorough and industrious. They value sequential thinking and need details. They collect data and critique information. They prefer to maximize certainty and are uncomfortable with subjective judgments. They seek intellectual competence and personal effectiveness. Creating concepts and models is their strong point.

Appropriate instructional techniques.

Type Two learners (Assimilators) excel in patterning, organizing, and analyzing skills, such as seeing relationships and interrelationships, identifying parts, ordering, prioritizing, classifying, and comparing. These learners are most comfortable when integrating reflections on experience into developing concepts. The favorite method is the presentation of information, preferably if the information is based on the learners' experience.

Hypothesized exhibit preferences for **Assimilators**:

Verbal descriptions - signs telling facts about the animals, displays which give an overview of an issue by presenting the conflicting points of view.

Baboon Reserve - textual messages on the signs, the bulletin board.

Himalayan Highlands - the world map listing conservation projects, the rotating panels which present the perspectives of different people regarding snow leopard conservation.

Kolb's **Converger** Style translated by McCarthy into Type Three: The Common Sense Learners

These learners perceive information abstractly and process it actively. They integrate theory and practice. They learn by testing theories and applying common sense. They rely heavily on kinetic involvement to learn, using body senses as a focus for understanding. They are down-to-earth problem-solvers, who resent being given answers. They need to try it themselves. They are skills oriented, experimenting and tinkering with things. They need to know how things work; they edit reality. They function best by gathering factual data from hands-on experiences. They do not stand on ceremony but get right to the point. They have a limited tolerance for fuzzy ideas and value strategic thinking. Their strength lies in the practical application of ideas. Because they are pragmatists, seeking utility and results, they may sometimes seem bossy and impersonal.

Appropriate instructional techniques.

Type Three learners (Convergers) excel at experimenting, manipulating materials, and building on givens. An encouraging environment should be created so that these learners may try things for themselves.

Hypothesized exhibit preferences for **Convergers**:

Verbal descriptions - signs asking questions which must be lifted or turned for the answer, exhibits which allow for trying one's own skills and experimenting with something, displays including touchable items.

Baboon Reserve - the lift panels, the ibex horns, the telescopes.

Himalayan Highlands - the radio tracking collar.

Kolb's **Accommodator** Style translated by McCarthy into Type Four: The Dynamic Learners

These learners perceive information concretely and process it actively. They integrate knowledge gained by personal experience and experimentation, learning by trial and error. They are outgoing, relying on intuition as a primary focus for understanding. They believe in self-discovery and excel when flexibility is needed. They often reach accurate conclusions in the absence of logical justification. They enrich reality by taking what is and adding something of themselves to it. They are risk takers who are at ease with people, but who may be seen as manipulative and pushy. Their strength lies in action, in presenting challenges, and in creating and testing new experiences. They need to learn on their own.

Appropriate instructional techniques.

Type Four learners (Accommodators) excel in integrating and evaluating skills such as verifying, explaining, summarizing, synthesizing, re-presenting, and re-focusing. Self-discovery is the favorite method, in which learners teach it to themselves and to others. They apply what they have learned in some personal, meaningful way.

Hypothesized exhibit preferences for **Accommodators**:

Verbal descriptions - exhibits which allow for trying one's own skills and experimenting with something, signs asking questions which must be lifted/turned for the answer, displays including touchable items.

Baboon Reserve - the telescopes, the ibex horns, the question lift panels.

Himalayan Highlands - no display would appear to be especially appealing to this group.

See Table 4 for a summary of the hypothesized exhibit preferences of the different learning styles.

Table 4
Hypothesized Exhibit Preferences of the Different Learning Styles

Exhibit	Gregorc's Styles	Kolb's Modes	Kolb's Styles
GA & CT Groups: Verbal Descriptions			
Signs telling facts about the animals	AS	AC/RO	Assimilator
Signs asking questions which you lift/turn for the answer	CS	CE/AE	Converger/ Accommodator
Displays which give an overview of an issue by presenting conflicting points of view	AR/AS	RO/AC	Diverger/ Assimilator
Exhibits which allow you to try your own skills and experiment	CR	AE/CE	Accommodator/ Converger
Displays which include touchable items[a]	CS/CR	AE/CE	Converger/ Accommodator
Displays which include silent videos/photographs[a]	AR	--[b]	--[b]
Displays which include audio recordings of information[a]	AS	--[b]	--[b]

Note. AS=Abstract-Sequential, CS=Concrete-Sequential, AR=Abstract-Random, CR=Concrete-Random; CE=Concrete Experience, RO=Reflective Observation, AC=Abstract Conceptualization, AE=Active Experimentation.
[a]The hypotheses related to the three exhibit types catering to the different modalities (i.e., kinesthesia -touchable items, sight -silent videos/photographs, hearing -audio recordings) are especially tenuous because the issue of modalities is not inherent to these theories. Modality strengths forms a parallel, yet separate, line of research into learning styles.
[b]The available descriptions did not provide sufficient information relevant to developing a hypothesis.

table continues

Table 4 continued
Hypothesized Exhibit Preferences of the Different Learning Styles

Exhibit	Gregorc's Styles	Kolb's Modes	Kolb's Styles
Baboon Reserve			
Telescopes	CR	AE/CE	Accommodator/ Converger
Touchable ibex horns	CS/CR	AE/CE	Converger/ Accommodator
Liftable question panels	CS	CE/AE	Converger/ Accommodator
Textual signs	AS	AC/RO	Assimilator
Bulletin board	AR/AS	RO/AC	Diverger/ Assimilator
Himalayan Highlands			
Rotating panels telling different points of view	AR/AS	RO/CE	Diverger/ Assimilator
Touchable radio collar	CS	CE	Converger
Diary excerpts about tracking a snow leopard	AR	RO/CE	Diverger
World map listing conservation projects	CS/AS	AC/RO	Assimilator
Sign with quotation from Buddhist writings	AR	RO	Diverger

Because learning styles have not been thoroughly examined in the context of leisure setting interpretives and because the displays being tested were not developed according to learning style characteristics, the hypothesized exhibit preferences should not be considered definitive hypotheses, but rather a structure within which to interpret the findings. Due to the exploratory nature of this research, these expected relationships might not be substantiated and/or others might appear. Moreover, one of the typologies might emerge as a superior predictor of exhibit preferences. Or, all of these classification systems might be shown to be ineffective in a group-oriented, recreational, informal education environment. Nonetheless, because this is unchartered territory, the accumulated data must be allowed to suggest their own relationships or lack thereof.

CHAPTER III:

RESULTS

Please note: Due to the exploratory nature of this research, findings significant at an alpha level of .10 have been reported.

All Four Subsamples

Background Characteristics

Analyses of the demographic variables showed the similarities and differences which existed among the background traits of the four groups (i.e., General Audience [GA], Conservation Trail [CT], Baboon Reserve [BR], and Himalayan Highlands [HH]). No significant differences were found among these groups with respect to the gender or education of the participants (see Table 5). The HH group, however, was found to consist of a greater proportion of younger visitors. In addition, the visitors in the GA sample tended to be visiting in larger groups, with more family members, more children, and in particular more preschoolers (2-4 years old), than the other three samples.

Two factors distinguished the CT visitors (the "target" group) from the other three samples (see Table 6). The CT group consisted of a larger proportion of Bronx Zoo/Wildlife Conservation Society (BZ/WCS) members and the individuals in this group tended to visit zoos more frequently. These two characteristics are related, of course, as members tend to visit more frequently than non-members $X^2(3, N=447)=128.178$, $p=.000$ (see Table 7).

Table 5
Similarities in Frequencies of Background Characteristics among the Four Subsamples

Characteristic	General Audience		Conservation Trail		Baboon Reserve		Himalayan Highlands	
	Visitor Group							
Gender	(n=100)		(n=102)		(n=110)		(n=113)	
Female	59	59%	65	64%	59	54%	71	63%
Male	41	41%	37	36%	51	46%	42	37%
					$X^2(3, N=425)=2.850$, $p=.415$			
Education	(n=100)		(n=102)		(n=110)		(n=115)	
Some H.S.[a]	3	3%	2	2%	2	2%	3	3%
H.S. grad	17	17%	22	22%	21	19%	15	13%
Tech.S. grad[b]	3	3%	1	1%	6	5%	3	3%
Some college	26	26%	23	23%	23	21%	35	30%
College grad	26	26%	28	27%	33	30%	31	27%
Post-grad	25	25%	26	25%	25	23%	28	24%
M	"Some college" for all four groups							
					$F(3,423)=0.17$, $p=.9172$			

[a]Some high school. [b]Technical school graduate.

Table 6
Differences in Frequencies of Background Characteristics among the Four Subsamples

Characteristic	General Audience		Conservation Trail		Baboon Reserve		Himalayan Highlands	
	Visitor Group							
Age	(n=100)		(n=102)		(n=110)		(n=114)	
18-24	18	18%	18	18%	18	16%	28	25%
25-34	28	28%	26	25%	36	33%	45	39%
35-44	34	34%	38	37%	36	33%	26	23%
45-54	12	12%	15	15%	14	13%	12	11%
55-64	6	6%	3	3%	4	4%	2	2%
65-up	2	2%	2	2%	2	2%	1	1%
M^a	35-44 (2.660)		35-44 (2.657)		35-44 (2.600)		**25-34 (2.281)**[b]	
					$F(3,422)=2.84$, $p=.0375$			
Visitor Group Composition[c]	(n=100)		(n=102)		(n=109)		(n=115)	
With children	71	**71%**	49	48%	68	62%	60	52%
Without children	29	**29%**	53	52%	41	38%	55	48%
					$X^2(3,N=426)=13.566$, $p=.004$			

table continues

Table 6 continued
Differences in Frequencies of Background Characteristics among the Four Subsamples

Characteristic	General Audience		Conservation Trail		Baboon Reserve		Himalayan Highlands	
BZ/WCS[d] Membership Status	(n=100)		(n=102)		(n=109)		(n=115)	
Non-member	85	85%	62	**61%**[b]	99	91%	104	90%
Member	15	15%	40	**39%**[b]	10	9%	11	10%
$X^2(3, N=426)=43.303$, $p=.000$; $F(3,422)=15.92$, $p=.0001$								
Frequency of Zoo Visits[e]	(n=100)		(n=102)		(n=110)		(n=115)	
less than 1	36	36%	18	18%	41	37%	43	37%
1 - 2	35	35%	43	42%	50	45%	54	47%
3 - 6	22	22%	23	23%	11	10%	16	14%
7 or more	7	7%	18	18%	8	7%	2	2%
M[f]	1 - 2 (2.000)		**1 - 2 (2.402)**[b]		1 - 2 (1.873)		1 - 2 (1.800)	
$X^2(9, N=427)=35.487$, $p=.000$; $F(3,423)=9.84$, $p=.0001$								

[a]The numbers in parentheses are the means of the six ordinal answer categories, not the age in years. [b]Bold type designates the visitor group that significantly differs from the others. [c]Group composition refers to whether children were reported to be visiting the zoo with the respondent that day, not necessarily to whether children accompanied the respondent to the observed Baboon Reserve or Himalayan Highlands display. [d]Bronx Zoo/Wildlife Conservation Society. [e]This category represents the average number of times each year the participants visit a zoo. [f]The numbers in parentheses are the means of the four ordinal answer categories, not the actual number of visits.

Table 7
Average Number of Annual Zoo Visits by BZ/WCS Members and Non-members

BZ/WCS Membership Status	Average No. of Annual Zoo Visits							
	less than 1		1-2		3-6		7 or more	
Non-members ($\underline{n}$=350)	135	39%	164	47%	40	11%	11	3%
Members ($\underline{n}$=76)	2	3%	18	24%	32	42%	24	32%
Totals ($\underline{N}$=426)	137	32%	182	43%	72	17%	35	8%

$X^2(3, \underline{N}=426)=129.149$, $\underline{p}=.000$

Learning Styles

Despite the variety of background characteristics, no differences in learning style distributions (for either Kolb's or Gregorc's typology) were found among the four groups (see Table 8). Therefore, all of Kolb's Learning Style Inventories (LSI) were combined (N=213) and all of the Gregorc Style Delineators (GSD) were combined (N=199)[15] for further analysis.

Within the overall zoo-going population, Assimilators were the most numerous (42%) of Kolb's styles and Convergers were the least (11%). Of the Gregorc styles, the largest proportion of zoo visitors were Concrete-Sequentials (41%) and the smallest portion were Concrete-Randoms (14%). (For a brief description of the characteristics associated with each style, see Tables 10 and 11.)

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[15]When using the Gregorc Style Delineator (GSD), an individual's predominant learning style is determined by the category receiving the highest score. In the general population it is natural to find that some individuals have equivalent strengths in two or more categories and thus utilize two or more different learning styles. In an attempt to uncover any relationships which may exist between the styles and exhibit components, however, only those individuals showing unique strengths were retained in analyses of the Gregorc typology. Those participants whose highest score was achieved on two or more categories could not be included in any one learning style classification. Consequently, 15 individuals were not classified (see Table 9); the total sample of GSDs amounted to 199. In contrast, Kolb's Learning Style Inventory (LSI) is scored by subtracting two of the scales from the other two scales and plotting the result on a graph (see Figure 1). As a result, each individual can be uniquely classified into one of the four learning styles.

Table 8
Learning Style Distributions among the Four Subsamples

Visitor Group	Kolb's Learning Styles: Diverger		Assimilator		Converger		Accommodator	
General Audience (n=50)	12	24%	17	34%	7	14%	14	28%
Conservation Trail (n=51)	15	29%	18	35%	6	12%	12	24%
Baboon Reserve (n=55)	15	27%	31	56%	4	7%	5	9%
Himalayan Highlands (n=57)	20	35%	23	40%	7	12%	7	12%
Total Sample (N=213)	62	29%	89	42%	24	11%	38	18%

$X^2(9, N=213)=13.618$, $p=.137$

Visitor Group	Gregorc's Learning Styles: Concrete-Sequential		Abstract-Sequential		Abstract-Random		Concrete-Random	
General Audience (n=48)	17	35%	10	21%	13	27%	8	17%
Conservation Trail (n=46)	18	39%	8	17%	11	24%	9	20%
Baboon Reserve (n=49)	22	45%	13	27%	6	12%	8	16%
Himalayan Highlands (n=56)	25	45%	9	16%	19	34%	3	5%
Total Sample (N=199)[a]	82	41%	40	20%	49	25%	28	14%

$X^2(9, N=199)=11.964$, $p=.215$

[a]Fifteen individuals were not included in this distribution as they showed equivalent strengths in more than one learning style and, hence, could not be uniquely classified.

Table 9
Gregorc Style Delineator (GSD) Scores Which Precluded the Classification of the Individual into a Unique Learning Style (n=15)

				GSD Scale Scores			
Subsample	Gender	Age	Education	CS[a]	AS[b]	AR[c]	CR[d]
General Audience	F	45-54	College grad	25	21	**27**	**27**
(n=2)	M	45-54	Post-grad	**26**	**26**	22	**26**
Conservation Trail (n=5)	F	45-54	Some college	**30**	20	**30**	20
	M	25-34	H.S. grad[e]	21	17	**31**	**31**
	F	18-24	Some college	**27**	**27**	20	26
	F	18-24	Tech.S. grad[f]	24	**26**	24	**26**
	F	35-44	College grad	**29**	17	25	**29**
Baboon Reserve	F	18-24	College grad	21	25	**27**	**27**
(n=6)	F	45-54	Some college	17	17	**33**	**33**
	F	25-34	H.S. grad	18	20	**31**	**31**
	M	35-44	Post-grad	**30**	**30**	21	19
	F	25-34	Tech.S. grad	**26**	**26**	**26**	22
	F	35-44	Some college	**29**	22	**29**	20
Himalayan Highlands	F	18-24	College grad	**26**	24	24	**26**
(n=2)	M	25-34	Some college	**28**	**28**	26	18

Note. This group of unclassified individuals does not differ in terms of gender, age, or education from the "classified" group.
[a]CS=Concrete-Sequential. [b]AS=Abstract-Sequential. [c]AR=Abstract-Random. [d]CR=Concrete-Random. [e]High school graduate. [f]Technical school graduate.

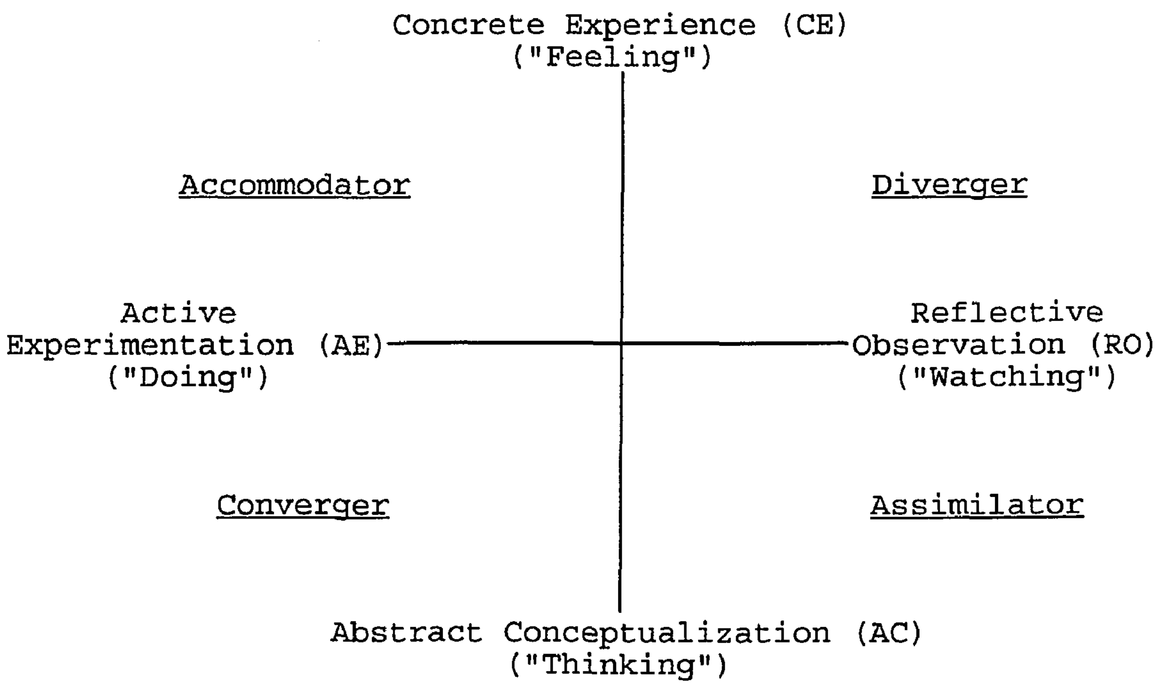

Figure 1. Kolb's cycle of learning, including the four learning modes (i.e., CE, RO, AC, and AE) and the four learning-style types (underlined). One's learning-style type is determined by plotting two combination scale scores, AC minus CE and AE minus RO, on a specially calibrated grid. The quadrant which contains the point of intersection of these two scores represents the individual's dominant learning style.

Table 10
Characteristics Associated with Each of **Kolb's Four Learning Styles**

Classification	General Characteristics
Diverger	Combines Concrete Experience and Reflective Observation modes. People with this learning style are best at viewing concrete situations from many different points of view. Their approach to situations is to observe rather than take action. They may enjoy situations that require generating a wide range of ideas, as in brainstorming sessions. They tend to have broad cultural interests and like to gather information. This imaginative ability and sensitivity to feelings is needed for effectiveness in arts, entertainment, and service careers.
Assimilator	Combines Abstract Conceptualization and Reflective Observation modes. People with this learning style are best at understanding a wide range of information and putting it into concise, logical form. They tend to be less focused on people and more interested in abstract ideas and concepts. Generally, they find it more important that a theory have logical soundness than practical value. This learning style is important for effectiveness in information and science careers.

table continues

Table 10 continued
Characteristics Associated with Each of **Kolb's Four Learning Styles**

Classification	General Characteristics
Converger	Combines Abstract Conceptualization and Active Experimentation modes. People with this learning style are best at finding practical uses for ideas and theories. They have the ability to solve problems and make decisions based on finding solutions to questions or problems. They would rather deal with technical tasks and problems than with social and interpersonal issues. These learning skills are important for effectiveness in specialist and technology careers.
Accommodator	Combines Concrete Experience and Active Experimentation modes. People with this learning style have the ability to learn primarily from "hands-on" experience. They tend to enjoy carrying out plans and involving themselves in new and challenging experiences. They tend to act on "gut" feelings rather than on logical analysis. In solving problems, they may rely more heavily on people for information than on their own technical analysis. This learning style is important for effectiveness in action-oriented careers such as marketing or sales.

Note. From LSI Learning-Style Inventory: Self-scoring inventory and interpretation booklet (Rev. ed.) (p. 7), by McBer & Company Training Resources Group, 1985, Boston: McBer & Company. Copyright 1981 by David A. Kolb, revised 1985. Adapted with permission.

Table 11
<u>Characteristics Associated with Each of **Gregorc's Four Learning Styles**</u>

Classification	General Characteristics
Concrete-Sequential	This learning preference is characterized by the propensity to derive information through direct, hands-on experience. CS learners exhibit extraordinary development of their five senses. They appreciate order and logical sequence of the if-then, premise-conclusion variety. They like touchable, concrete materials. When confronted with a learning situation, they prefer step-by-step directions. They not only look for directions but they follow them. They like clearly ordered presentations and a quiet atmosphere.
Abstract-Sequential	This learning preference is characterized by excellent decoding abilities with written, verbal, and image symbols. AS learners have a wealth of conceptual "pictures" in their minds against which they match what they read, hear, or see in graphic and pictorial form. They possess and like to use reading, listening, and visual translation skills. A symbol or picture is worth a thousand words to them. These learners prefer a presentation that has substance, is rational, and is sequential in nature. They are able to extract main ideas from a logical presentation. They learn well from authorities and like vicarious experiences.

table continues

Table 11 continued
<u>Characteristics Associated with Each of **Gregorc's Four Learning Styles**</u>

Classification	General Characteristics
Abstract-Random	AR learners are distinguishable by their attention to human behavior and a capacity to sense and interpret "vibrations." They are attuned to nuances of atmosphere and mood. They associate the medium with the message. In doing so, they evaluate a learning experience as a whole. They prefer to receive information in an unstructured manner and therefore like group discussions, activities which involve multi-sensory experiences, and busy environments. They prefer freedom from rules and guidelines. They seem to gather information and delay reaction; they organize material through reflection to get what they want.
Concrete-Random	This learning preference is characterized by an experimental attitude and accompanying behavior. CR learners get the gist of ideas quickly and demonstrate the ability to make intuitive leaps in exploring unstructured (as well as structured) problem-solving experiences. They utilize the trial-and-error approach in acquiring information. They do not like cut-and-dried procedures that deny them opportunities to find answers in their own ways. They do not respond well to teacher intervention in their dependent efforts. They work well independently or in small groups.

<u>Note.</u> From "Learning/teaching styles: Their nature and effects," by A. F. Gregorc, 1979, in <u>Student learning styles: Diagnosing and prescribing programs</u> (pp. 20-22), by the National Association of Secondary School Principals (Ed.), Reston, VA: Editor. Copyright 1979 by the National Association of Secondary School Principals. Adapted with permission.

Learning style was not related to a person's age or to the level of schooling she or he had completed. Nor was it related to how often one visits a zoo or to whether or not an individual is a BZ/WCS member.

However, for both the LSI and the GSD, learning style was related to gender (see Table 12). Within Kolb's typology, females were more likely than males to be Divergers, whereas males were more likely than females to be Assimilators or Convergers. Gregorc's typology showed that females were more likely than males to be Abstract-Randoms; males were slightly more apt than females to be Abstract-Sequentials.

Because support has been found (Cornwall & Manfredo, 1994; Geiger, Boyle, & Pinto, 1992; Ruble & Stout, 1990) for Kolb's four learning modes (e.g., Concrete Experience, Reflective Observation, etc.) but not for his four learning-style types (e.g., Diverger, Assimilator, etc.), visitors completing Kolb's LSI were also classified according to their primary learning mode. (For a summary of the characteristics associated with each mode, see Table 13.)

Once again, no differences appeared among the four visitor groups with regard to primary learning mode distribution (see Table 14).[16] Moreover, primary learning

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[16]An individual's primary learning mode is determined by the scale receiving the highest score. As with the GSD, those visitors whose highest score was achieved on two or more scales could not be included in any one category. Consequently, 13 participants were not classified (see Table 15); the sample totaled 200.

Table 12
Distribution of Learning Styles/Modes Within Each Gender for the Entire Sample

Kolb's Learning Styles	Gender: Female		Male		Total	
Diverger	46	**40%**	15	**16%**	61	29%
Assimilator	40	34%	49	52%	89	42%
Converger	8	7%	15	16%	23	11%
Accommodator	22	19%	16	17%	38	18%
Total	116	100%	95	100%	211	100%

$X^2(3,\underline{N}=211)=17.829$, $\underline{p}=.000$

Kolb's Learning Modes	Female		Male		Total	
Concrete Experience	16	**15%**	1	**1%**	17	9%
Reflective Observation	34	31%	22	25%	56	28%
Abstract Conceptualization	24	22%	31	35%	55	28%
Active Experimentation	36	33%	34	39%	70	35%
Total	110	100%	88	100%	198	100%

$X^2(3,\underline{N}=198)=14.489$, $\underline{p}=.002$

Gregorc's Learning Styles	Female		Male		Total	
Concrete-Sequential	49	39%	33	46%	82	41%
Abstract-Sequential	21	17%	19	26%	40	20%
Abstract-Random	39	31%	10	**14%**	49	25%
Concrete-Random	18	14%	10	14%	28	14%
Total	127	100%	72	100%	199	100%

$X^2(3,\underline{N}=199)=8.088$, $\underline{p}=.044$

Note. Bold type designates X^2 or cell-X^2 significant at $\underline{p}<.10$.

mode was related to gender (refer to Table 12). Females were more likely than males to prefer learning by Concrete Experience.

Table 13
Characteristics Associated with Each of **Kolb's Four Learning Modes**

Classification	General Characteristics
Concrete Experience (CE)	Learning from feeling Learning from specific experiences Relating to people Being sensitive to feelings and people
Reflective Observation (RO)	Learning by watching and listening Carefully observing before making judgments Viewing issues from different perspectives Looking for the meaning of things
Abstract Conceptualization (AC)	Learning by thinking Logically analyzing ideas Systematic planning Acting on an intellectual understanding of a situation
Active Experimentation (AE)	Learning by doing Ability to get things done Risk-taking Influencing people and events through action

Note. From LSI Learning-Style Inventory: Self-scoring inventory and interpretation booklet (Rev. ed.) (p. 5), by McBer & Company Training Resources Group, 1985, Boston: McBer & Company. Copyright 1981 by David A. Kolb, revised 1985.

Table 14
Distribution of Kolb's Primary Learning Modes among the Four Subsamples

Visitor Group	Kolb's Learning Modes							
	CE[a] (feeling)		RO[b] (watching)		AC[c] (thinking)		AE[d] (doing)	
General Audience (n=46)	8	17%	9	20%	12	26%	17	37%
Conservation Trail (n=50)	3	6%	12	24%	12	24%	23	46%
Baboon Reserve (n=52)	3	6%	18	35%	16	31%	15	29%
Himalayan Highlands (n=52)	3	6%	17	33%	15	29%	17	33%
Total Sample (N=200)[e]	17	9%	56	28%	55	28%	72	36%

$X^2(9, N=200)=11.025$, $p=.274$

[a]CE=Concrete Experience. [b]RO=Reflective Observation. [c]AC=Abstract Conceptualization. [d]AE=Active Experimentation. [e]Thirteen individuals were not included in this distribution as they showed equivalent strengths in more than one learning mode and, hence, could not be uniquely classified.

Table 15
Kolb's Primary Learning Mode Scores Which Precluded the Classification of the Individual into a Unique Learning Mode Category (n=13)

				LSI[a] Scale Scores			
Subsample	Gender	Age	Education	CE[b]	RO[c]	AC[d]	AE[e]
General Audience (n=4)	M	35-44	Tech.S. grad[f]	22	26	**36**	**36**
	F	18-24	Some college	25	**32**	**32**	31
	M	55-64	Some college	**32**	25	**32**	31
	M	65-up	College grad	25	29	**33**	**33**
Conservation Trail (n=1)	F	18-24	H.S. grad[g]	20	**34**	32	**34**
Baboon Reserve (n=3)	M	18-24	H.S. grad	25	29	**33**	**33**
	F	25-34	Post-grad	**36**	30	**36**	18
	F	35-44	Some college	29	**33**	25	**33**
Himalayan Highlands (n=5)	M	25-34	Some H.S.	30	28	**31**	**31**
	F[h]	25-34	Some college	31.5	**35.5**	17.5	**35.5**
	F	18-24	Some college	**31**	**31**	29	29
	M	25-34	Some college	21	**37**	25	**37**
	M	35-44	Some college	**35**	**35**	19	31

Note. This group of unclassified individuals does not differ in terms of gender, age, or education from the "classified" group.
[a]LSI=Kolb's Learning Style Inventory. [b]CE=Concrete Experience. [c]RO=Reflective Observation. [d]AC=Abstract Conceptualization. [e]AE=Active Experimentation. [f]Technical school graduate. [g]High school graduate. [h]Because this individual skipped one row on the inventory, each of the four omitted items was scored as 2.5 (i.e., the mean of the four possible rankings).

The Zoo Sample in Relation to the Normative Groups

David A. Kolb: The Learning Style Inventory (LSI)

The technical specifications manual for the Learning-Style Inventory (1985) provides normative statistics for the standard form of the LSI but not for the scrambled version, which was used in this study. Ruble and Stout (1990, 1991) however, have published descriptive statistics from their research for the scrambled version.

The present sample, in comparison with both the normative data and Ruble and Stout's work (see Table 16), appears similar on the Concrete-Experience (CE), Reflective-Observation (RO), and Abstract-Conceptualization (AC) scales. The zoo visitors as a group, however, scored lower on the Active-Experimentation (AE) scale, which subsequently lowered their AE-(minus)RO combination score. Consequently, fewer individuals were classified as Convergers or Accommodators; the greater proportion of zoo participants were categorized as Divergers or Assimilators. In other words, this zoo sample is composed of more Assimilators and Divergers than the normative group.

In addition, the normative data shows males and females to have equivalent means on the AE-RO score (M=5.4). Although the means for both the males (M=0.54) and the females (M=-0.40) in the zoo sample are substantially lower than those from the normative group (due to the low AE scores), the two

Table 16
Descriptive Statistics for Kolb's Learning Style Inventory

Scale	Current Sample (N=213) Scrambled Version M	SD	Ruble & Stout 1990[a] (N=339) Scrambled Version M	SD	Ruble & Stout 1991[b] (N=403) Scrambled Version M	SD	Normative Sample[c] (N=1446) Standard Version M	SD
CE	26.4	6.2	24.7	6.4	24.6	5.6	26.0	6.8
RO	31.6	5.9	31.3	6.4	30.3	6.7	29.9	6.5
AC	30.4	7.0	30.4	6.2	31.8	6.5	30.3	6.7
AE	31.6	6.3	33.5	6.1	33.6	6.6	35.4	6.9
AC-CE	4.1	11.8	5.7[d]		7.2	9.9	4.3	11.4
AE-RO	0.08	10.6	2.2[d]		3.4	11.4	5.9	11.0

[a]From "Reliability, construct validity, and response-set bias of the revised Learning-Style Inventory (LSI-1985)," by T. L. Ruble and D. E. Stout, 1990, Educational and Psychological Measurement, 50(3), p. 622. Copyright 1990 by Educational and Psychological Measurement, Inc. [b]From "Reliability, classification stability, and response-set bias of alternate forms of the Learning-Style Inventory (LSI-1985)," by T. L. Ruble and D. E. Stout, 1991, Educational and Psychological Measurement, 51(2), p. 484. Copyright 1991 by Educational and Psychological Measurement, Inc. [c]Statistics for the normative sample are from Learning-Style Inventory, 1985: Technical Specifications, (p. 5), by McBer & Company, 1985, Boston: McBer & Company. [d]This calculation was extrapolated from the individual scale scores reported.

genders are still similar (i.e., they fall on the same half of the Learning-Style Type grid). Moreover, in the normative sample the mean for males on the AC-CE combination score was 7.0 and the mean for females was 2.1. The zoo sample showed similar results, with the means for males and females being 7.08 and 1.58 respectively. That is to say, the relationship which appeared among the current sample between learning style/mode and gender exists within the normative sample as well.[17] Females are more likely to prefer learning by Concrete Experience; males by Abstract Conceptualization. Hence, females are more likely to be classified as Divergers or Accommodators; males as Assimilators or Convergers.

In fact, in the technical manual for the original nine-item LSI (1976, p. 24), Kolb specifically stated, "Current data suggest that, on the average, men and women score differently on the Learning Style Inventory. Women tend to score higher on the Concrete Experience orientation while men tend toward Abstract Conceptualization." He advised that this finding be interpreted cautiously, however, due to the small number of females that it was based on and to the fact that education and career choice often interact with gender differences. Nonetheless, the revised 12-item LSI and larger sample sizes seem to have born out this early suspicion.

The last point to be noted here is significant to Kolb's

[17]McCarthy, B. (1987) also reported this relationship among her sample of 2,367 teachers and administrators (p. 81).

experiential learning theory. In the present study the intercorrelations of the four LSI scales support Kolb's bipolar model (see Table 17). The strongest negative correlations occur between the postulated opposite pairs (i.e., CE with AC [-.58] and AE with RO [-.50]).

Table 17
Intercorrelations of the Four LSI Scales

	Current Sample (scrambled version)				Normative[a] and Scrambled Version[b] Samples			
Scale	CE	RO	AC	AE	CE	RO	AC	AE
CE	--				--	-.38	-.39	-.25
RO	-.33	--			-.32	--	-.26	-.38
AC	-.58	-.09	--		-.42	-.15	--	-.33
AE	-.03	-.50	-.46	--	-.22	-.33	-.30	--

Note. In the right-hand matrix, coefficients below the diagonal are for the normative sample; those above the diagonal are from Ruble & Stout's (1990) scrambled version sample.

[a]Pearson correlations for the normative sample (N=1446) are from Learning-Style Inventory, 1985: Technical Specifications, (p. 6), by McBer & Company, 1985, Boston: McBer & Company.

[b]Correlations for the scrambled version of the LSI are from "Reliability, construct validity, and response-set bias of the revised Learning-Style Inventory (LSI-1985)," by T. L. Ruble and D. E. Stout, 1990, Educational and Psychological Measurement, 50(3), p. 627. Copyright 1990 by Educational and Psychological Measurement, Inc.

Anthony F. Gregorc: The Gregorc Style Delineator (GSD)

In similar fashion, the Gregorc Style Delineator scores from the present study were compared to research cited in the Gregorc Style Delineator: Development, Technical and Administration Manual (Gregorc, 1984).

One study cited (Gregorc, 1982) was conducted to assess the reliability (i.e., stability, repeatability) of the GSD. As such, the GSD was administered to a group of 110 adults on two separate occasions. In comparison to the mean scale scores which resulted from each of these two testings, all of the means from the zoo visitors are lower (see Table 18). Moreover, the standard deviations from the zoo study are half those from Gregorc's research. Additionally, the rank order of the scales is different between the present study and the Gregorc study. The two scales with the highest relative scores (AR and CS) are inverted, as are the two scales with the lowest relative scores (CR and AS). That is, the mean scale scores ranked from highest to lowest for Gregorc's study are AR-CS-CR-AS, whereas the ranked scale scores for the present study are CS-AR-AS-CR.

Another study cited in the GSD manual (Page, n.d.) was conducted to evaluate the relationships between the four scale scores and eight other descriptive variables. Hence, this study also produced a set of mean scale scores to which the present study's could be compared (refer to Table 18). The rank order of the mean scale scores from Page's research

Table 18
Descriptive Statistics for the Gregorc Style Delineator

Scale	Current Sample (N=214) M	Current Sample (N=214) SD	Gregorc (1982) 1st testing (N=110) M	Gregorc (1982) 1st testing (N=110) SD	Gregorc (1982) 2nd testing (N=110) M	Gregorc (1982) 2nd testing (N=110) SD	Page (n.d.) (N=361) M	Page (n.d.) (N=361) SD
AR	25.0	5.3	29.1	12.0	29.5	11.4	26.2	7.2
CS	26.6	5.6	28.6	11.1	29.2	10.9	24.7	8.2
CR	24.1	4.8	27.9	11.6	28.2	11.5	23.7	7.5
AS	24.4	4.5	27.4	10.5	27.5	11.9	22.4	6.0

Note. Statistics for both Gregorc (1982) and Page (n.d.) are from Gregorc Style Delineator: Development, Technical and Administration Manual (Rev. ed.) (pp. 19, 36-39), by A. F. Gregorc, 1984, Columbia, CT: Gregorc Associates, Inc. Copyright 1982 by Anthony F. Gregorc, Ph.D., revised 1984.

corresponds with that of the Gregorc study previously cited. On the other hand, despite slightly greater dispersion among the four scale means (i.e., 26.2 [highest] to 22.4 [lowest]), these scores are closer to those of the zoo sample than are the Gregorc study scores. The standard deviations from Page's sample are closer to those of the zoo sample as well.

Page's research also provided correlations between the four scale scores. Both the current zoo sample and Page's sample demonstrate positive correlations between two pairs of scales (AS-CS and AR-CR) and negative correlations between the other four paired scale combinations (CS-AR, CS-CR, AS-AR, and

AS-CR; see Table 19). Whereas the two positive correlations from Page's sample are much stronger than the positive correlations from the zoo visitors, the four negative correlations from the present study are much stronger than those reported by Page.

In all, this comparative analysis suggests that while zoo visitors may form a slightly different population from samples available in the literature, the GSD results are in accordance with demonstrations of the instrument's performance in previous research.

Table 19
Intercorrelations of the Four GSD Scales

	Current Sample (N=214)				Page (n.d.) (N=361)			
Scale	CS	AS	AR	CR	CS	AS	AR	CR
CS	--				--			
AS	.15	--			.53	--		
AR	-.60	-.59	--		-.15	-.06	--	
CR	-.64	-.45	.15	--	-.28	-.004	.49	--

Note. Coefficients for Page (n.d.) are from Gregorc Style Delineator: Development, Technical and Administration Manual (Rev. ed.) (pp. 36-39), by A. F. Gregorc, 1984, Columbia, CT: Gregorc Associates, Inc. Copyright 1982 by Anthony F. Gregorc, Ph.D., revised 1984.

The General Audience (GA) and Conservation Trail (CT) Subsamples

Comparison of the Two Subsamples

The Conservation Trail participants were compared/ contrasted to the General Audience as these two groups responded to the same survey.

Regarding background characteristics, the General Audience was found to be visiting in larger groups, $F(1,199)=8.53$, $p=.0039$, with a greater number of family members, $F(1,199)=5.94$, $p=.0157$, and children, $F(1,200)=8.06$, $p=.0050$, on average, than the Conservation Trail group. Moreover, infants, $F(1,200)=5.45$, $p=.0205$, preschoolers, $F(1,200)=9.67$, $p=.0021$, and elementary-grade children, $F(1,200)=4.15$, $p=.0430$, were more often present in the General Audience than at the Conservation Trail. Simply, more groups at the Conservation Trail than in the General Audience consisted of adults without children, $X^2(1,N=202)=11.039$, $p=.001$.

The survey completed by the General Audience and the Conservation Trail groups asked visitors to rate seven different types of exhibits on a six-point scale from "very unappealing" to "very appealing" (see Table 20). In order to test for differences between these two groups, the seven exhibits were factor analyzed for each sample separately. In

Table 20
General Audience and Conservation Trail Participants' Ratings of the Appeal of Different Types of Exhibits

	Visitor Group					
	General Audience			Conservation Trail		
Type of Exhibit	n	M	SD	n	M	SD
Exhibits which allow you to try your own skills and experiment with something	100	5.35	0.78	102	5.10	1.11
Displays which include items you can touch	99	5.30	1.01	101	5.27	1.02
Signs asking questions which you lift/turn for the answer	100	4.02	1.31	102	4.22	1.21
Displays which include silent videos or photographs	100	4.37	1.19	102	4.26	1.28
Displays which include recordings of information that you can hear	100	4.58	1.16	102	4.66	1.16
Signs telling facts about the animals	100	5.07	0.90	102	5.26	0.87
Displays which give an overview of an issue by presenting the conflicting views	100	4.61	1.18	102	4.62	1.08

Note. Rating scale: 6=very appealing, 5=appealing, 4=somewhat appealing, 3=somewhat unappealing, 2=unappealing, 1=very unappealing.

both cases, the analysis resulted in the same three factors.[18]

A multivariate analysis of variance was then conducted for each of the factors to determine whether the GA and CT groups differed in their ratings. No differences appeared between these two groups regarding their preferences for the three exhibit-type categories.

The survey also asked visitors to rate five items as to how important they were in deciding which exhibits to view (see Table 21). In this case, univariate analyses of variance showed that no differences in ratings existed between the GA and CT groups.

[18]Because it is not pertinent to the immediate discussion, the details of the factors will not be described until later. Table 23, however, can be used to identify the three factors.

Table 21
General Audience and Conservation Trail Participants' Ratings of the Importance of Various Elements in Deciding Which Exhibits to Visit

Decision Factor	General Audience n	General Audience M	General Audience SD	Conservation Trail n	Conservation Trail M	Conservation Trail SD
The interests of the children in your group[a]	71	5.65	0.66	48	5.54	0.87
The directional signs along the paths	100	5.28	1.07	101	5.17	1.20
The interests of the adults in your group	100	4.80	1.16	100	5.04	1.10
The zoo map you are carrying	100	4.94	1.36	101	4.89	1.35
The adults' opinions of what might be good for the children[a]	70	4.40	1.50	48	4.63	1.27

Note. Rating scale: 6=very important, 5=important, 4=somewhat important, 3=somewhat unimportant, 2=unimportant, 1=very unimportant.
[a]Included here are the ratings only of those participants who were visiting with children.

Learning Styles in Relation to Background Characteristics

Because of the similarity in learning style distribution (refer to Table 8) and in responses between these two samples, they were merged to test the effects of learning style. That is, the GA surveys which included Kolb's LSI were combined with those from the CT group; the GA and CT surveys containing the GSD were combined. As a result, there were 101 LSIs and 101 GSDs. Each learning style typology was analyzed separately.

Kolb's learning styles were found to be related to gender (see Table 22). As in the total sample (i.e., N=213), females were more likely than males to be Divergers, whereas males were more likely than females to be Convergers or Assimilators. Furthermore, Assimilators reported visiting a zoo more frequently than either Convergers or Accommodators, $F(3,97)=2.70$, $p=.0500$.

Kolb's primary learning modes also were found to be related to gender (refer to Table 22). Females were more likely than males to prefer learning by Concrete Experience, $F(3,92)=3.15$, $p=.0286$.

The Gregorc learning styles showed no relationships to other background characteristics of the individuals.

Table 22
Distribution of Learning Styles/Modes Within Each Gender for the General Audience and Conservation Trail Groups Combined

Kolb's Learning Styles	Gender: Female		Male		Total	
Diverger	21	**40%**	6	**13%**	27	27%
Assimilator	15	28%	20	42%	35	35%
Converger	4	8%	9	19%	13	13%
Accommodator	13	25%	13	27%	26	26%
Total	53	100%	48	100%	101	100%

$X^2(3, \underline{N}=101)=10.750$, $\underline{p}=.013$

Kolb's Learning Modes	Female		Male		Total	
Concrete Experience	10	**20%**	1	**2%**	11	11%
Reflective Observation	12	24%	9	20%	21	22%
Abstract Conceptualization	9	18%	15	33%	24	25%
Active Experimentation	20	39%	20	44%	40	42%
Total	51	100%	45	100%	96	100%

$X^2(3, \underline{N}=96)=8.952$, $\underline{p}=.030$

Gregorc's Learning Styles	Female		Male		Total	
Concrete-Sequential	24	36%	11	39%	35	37%
Abstract-Sequential	9	14%	9	32%	18	19%
Abstract-Random	19	29%	5	18%	24	26%
Concrete-Random	14	21%	3	11%	17	18%
Total	66	100%	28	100%	94	100%

$X^2(3, \underline{N}=94)=5.679$, $\underline{p}=.128$

Note. Bold type designates X^2 or cell-X^2 significant at $\underline{p}<.10$.

Exhibit Type Preferences

The primary focus of this study was to establish whether learning styles could be related to preferences for particular types of exhibits. Because gender was found to be related to learning styles and because of the potential relevance to leisure research, exhibit type preferences were first examined solely in relation to demographic factors (i.e., excluding learning style). For this analysis the General Audience and Conservation Trail samples were completely combined (i.e., N=202).

To begin with, the survey responses to preferences for seven exhibit descriptions (refer to Table 20) were factor analyzed. This analysis resulted in three distinct factors: (1) "hands-on" exhibit types, (2) sensory exhibits, and (3) textual exhibits (see Table 23).

The hands-on and sensory-exhibit factors showed a low positive correlation (r=.26). Textual exhibits were essentially uncorrelated with either of the other two exhibit types (see Table 24).

Stepwise multiple regression analyses were then performed regressing each of the three exhibit type factors on the following seven demographic variables: gender, age, education, number of annual zoo visits, BZ/WCS membership, and visiting the zoo with or without children and with or without adult companions.

Table 23
Factor Structure of Exhibit Types for the General Audience and Conservation Trail Samples

Type of Exhibit	Abbreviation
1. Exhibits which allow you to try your own skills and experiment with something	Experiment
2. Displays which include items you can touch	Touch
3. Signs which ask you questions, but only tell you the answer if you lift them or turn then over	Lifts
4. Displays which include silent videos or photographs	Look
5. Displays which include recordings of information that you can hear	Listen
6. Signs telling facts about the animals	Facts
7. Displays which give you an overview of an issue by presenting the conflicting points of view	Overview

Factor 1 Hands-on Exhibits		Factor 2 Sensory Exhibits		Factor 3 Textual Exhibits	
Experiment	.855				
Touch	.805				
Lifts	.559				
		Look	.883		
		Listen	.866		
				Facts	.833
				Overview	.696

Note. N=200.

Table 24
Intercorrelations Between Exhibit-Type Factors for the General Audience and Conservation Trail Samples

Exhibit-Type Factor	1	2	3
1. Hands-on	--	.26	.08
2. Sensory		--	.13
3. Textual			--

Note. *N*=202.

Hands-on exhibits were preferred by females, younger participants,[19] those accompanied by children, and those who visit zoos less frequently (marginal). Sensory exhibits were rated more appealing by less educated[20] individuals and by those visiting without an adult companion. Textually focused exhibits were preferred by those who visit zoos more frequently and by participants not accompanied by an adult.

In order to examine the effects of gender specifically, a multivariate analysis of variance was performed for each of

[19]Regression results indicating "younger" or "older" individuals refer to the following four age categories: 18-24 years old, 25-34, 35-44, 45 and older.

[20]Regression results indicating "less" educated or "more" educated individuals refer to the following spectrum of four education levels: (1) technical school graduate, high school graduate, or less; (2) some college completed; (3) college graduate; (4) post-graduate.

the three factors. Males and females did not differ on their preferences for sensory or textual exhibits. They did differ, however, on their preferences for hands-on displays, $F(3,196)=2.18$, $p=.0918$. Participatory lift questions, $F(1,198)=3.19$, $p=.0755$, and exhibits which include touchable items, $F(1,198)=5.16$, $p=.0241$, were rated as more appealing by females than by males. In contrast, exhibits which allow individuals to try their own skills and experiment were found equally appealing by both men and women.

Stepwise multiple regression analyses also were conducted to explore the effects of learning style on exhibit type preferences. Because the investigation of learning styles is theory-driven, each of the seven exhibit types, rather than the three exhibit type factors, was examined individually.

In addition to learning style, six distinct demographic variables were entered into the regression equations (i.e., gender, age, education, number of annual zoo visits,[21] and visiting with or without children and with or without adult companions). This configuration of "predictor" variables allowed a test of whether learning style would show itself to be a significant predictor of exhibit type preference when in "competition" with other background factors.

To analyze Gregorc's styles, the Delineator's scale scores (as continuous variables) were included in the

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[21]BZ/WCS membership was not included in these regressions due to its moderate correlation with number of annual zoo visits.

regressions along with the demographic characteristics. For Kolb's Inventory, either the actual scale scores (continuous variables) or the categorical styles (i.e., determined by combinations of the scale scores) were added to the background variables in the regression models.

To begin with, all (i.e., both males and females) of the Kolb cases were analyzed together, as were all of the Gregorc cases. If for any exhibit type, gender appeared as a significant variable, then that exhibit was analyzed separately for males and females.

Applying descriptions found in the literature, different learning styles were hypothesized to prefer certain types of exhibits (refer to Table 4). The specifically stated hypotheses are all in the positive direction (e.g., "so-and-so" style would be expected to prefer "such-and-such" exhibit type, rather than "so-and-so" style would <u>not</u> prefer "such-and-such" exhibit type). Nonetheless, the regression results often appeared in the reverse fashion. In these cases, whereas the hypotheses may not have been confirmed, they also were not rejected, but (in some instances) actually supported indirectly. (Tables 25-27 summarize the expectations as well as the relevant results of the stepwise regression analyses.)

Using Kolb's styles, preferences for five of the exhibit types were shown to be related to the gender of the participant. The two that were unrelated to gender were the "liftable/turnable" question-answer signs and exhibits which allow for trying one's skills and experimenting. Neither of the expected styles (Accommodators or Convergers) were shown to prefer exhibits which allow a person to experiment. However, Assimilators, in keeping with theory, tended to rate this type of exhibit less appealing. For the participatory signs, no learning style was a significant indicator of preference. (See Table 25.)

The five exhibits for which gender was a factor were then analyzed for males and females separately. Due to the small number of male Divergers and female Convergers, these two categories were eliminated from their respective analyses.

In other words, only the Assimilators', Convergers', and Accommodators' preferences were analyzed among the males. For four of the five exhibit types, no learning style appeared as a significant indicator of preference. For "displays including touchable items," nonetheless, the hypothesis was upheld: (male) Accommodators were the style most likely to prefer this type of exhibit.

Among the females, only the Divergers', Assimilators', and Accommodators' ratings were analyzed. The expectation that Assimilators would prefer "displays which provide overviews of issues by presenting conflicting views" was confirmed among females. On the other hand, the expectation that Assimilators also would prefer "signs telling facts about the animals" was contradicted by the finding that Assimilators

Table 25

The Exhibit Type Preferences of Kolb's Learning Styles: Expected Relationships and Regression Analyses Results for the General Audience and Conservation Trail Samples

Exhibit Type	Style Expected to "Like" the Exhibit	Actual Findings[a]
Signs telling facts about the animals	Assimilators	M: ----- F: Assimilators did not like
Signs asking questions which you lift/turn for the answer	Convergers/ Accommodators	-----
Displays giving issue overviews by presenting the conflicting views	Divergers/ Assimilators	M: ----- F: Assimilators liked
Exhibits which allow you to try your skills and experiment	Accommodators/ Convergers	Assimilators did not like
Displays with touchable items	Convergers/ Accommodators	M[b]: Accommodators liked F: -----
Displays with silent videos or photographs	**[c]	M: ----- F: Accommodators did not like
Displays with recordings of information that you can hear	**[c]	M: ----- F: Assimilators liked

Note. The word "like" is used in place of "find more appealing." M=Males; F=Females. Dashes indicate that no learning style was a significant predictor of preference for the exhibit type.

[a]N=101. Due to small cell sizes, Divergers were excluded from the males' analyses (n=42); Convergers were excluded from the females' (n=49). [b]n=41. [c]No hypothesis was proffered.

tended to rate this exhibit type less appealing.[22] Of the exhibit types related specifically to modalities, Assimilators were most likely to prefer informational audio recordings and Accommodators were most likely to find silent videos/photographs less appealing.[23] No learning style among females emerged as being related to preferences for touchable items.

Considering the regression analyses involving Kolb's learning mode scales (CE, RO, AC, AE), again the preferences for two exhibit types were unrelated to gender: participatory signs and exhibits which allow for experimenting. First, preferences for participatory question-answer signs were not found to be related to learning style. Second, as would be expected, exhibits which allow a visitor to experiment were less appealing to those scoring higher in Abstract-Conceptualization. (See Table 26.)

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[22]Factor analysis of the entire sample found "displays which provide overviews of issues" and "signs telling animal facts" to compose one factor (i.e., to measure a similar underlying construct). However, regression analyses employing composite factors, rather than the individual exhibit types, would fail to expose the subtle differences among learning styles and specific exhibits such as that reported here.

[23]The relationships involving exhibits which emphasize a certain modality (e.g., sight, hearing) are somewhat difficult to interpret given the context of Kolb's theory. These findings may be best viewed as supplemental and not as inherently related to Kolb's structure.

Table 26

The Exhibit Type Preferences of Kolb's Learning Modes: Expected Relationships and Regression Analyses Results for the General Audience and Conservation Trail Samples

Exhibit Type	Mode Expected to "Like" the Exhibit	Actual Findings[a]
Signs telling facts about the animals	AC / RO	M: ----- F: CE liked
Signs asking questions which you lift/turn for the answer	CE / AE	-----
Displays giving issue overviews by presenting the conflicting views	RO / AC	M: ----- F: AE did not like
Exhibits which allow you to try your skills and experiment	AE / CE	AC did not like
Displays with touchable items	AE / CE	M[b]: AC did not like F: RO did not like
Displays with silent videos or photographs	**[c]	M: AC did not like AE did not like F: AC liked
Displays with recordings of information that you can hear	**[c]	M: ----- F: CE did not like

Note. The word "like" is used in place of "find more appealing." M=Males; F=Females. Dashes indicate that no learning style was a significant predictor of preference for the exhibit type.

[a]*N*=101; M:*n*=48; F:*n*=53. [b]*n*=46. [c]No hypothesis was proffered.

The five remaining exhibits were then re-analyzed for males and females separately. Among males, no learning style was shown to be an indicator of preference for signs relating animal facts, exhibits providing overviews of issues, or displays including audio recordings. In accord with Kolb's theory however, male visitors scoring higher on Abstract-Conceptualization found displays with touchable items to be less appealing. Additionally, displays including silent videos or photographs were rated less appealing by the male respondents scoring higher on Abstract-Conceptualization or higher on Active-Experimentation.

Among females, one learning mode appeared as a significant indicator of preference for each of the five exhibit types. First, consistent with predictions based on Kolb's theory, those scoring higher on Active-Experimentation were more likely to find displays providing overviews of issues less appealing. Second, also along Kolb's theoretical lines, displays with touchable items were rated less appealing by female respondents scoring higher on Reflective-Observation. Third, contrary to expectations, visitors scoring higher on Concrete-Experience expressed a preference for signs telling facts about the animals. Fourth, females who were stronger in Abstract-Conceptualization preferred displays that included silent videos or photographs. Finally, those scoring higher on Concrete-Experience were likely to report lower ratings of appeal for displays including audio recordings.

Gregorc's styles also were examined in relation to preferences for certain types of exhibits. For only one exhibit type did gender hold the possibility of being a significant influence: displays presenting an overview of an issue. When males and females were disaggregated, the result in each case was the same as for the total sample: no variables were significant indicators of preference for this overview-type of exhibit. (See Table 27.)

In keeping with predictions based on Gregorc's theory, the higher that individuals scored in the Abstract-Sequential style, the less likely they were to prefer participatory question-answer signs, exhibits which allow one to experiment, and displays with items to touch. Contrary to expectations, those higher in the Abstract-Sequential style (rather than those lower in the AS style) tended to rate informational audio recordings as less appealing. No learning style was found to be a significant predictor of preference for either signs telling animal facts or displays including silent videos/photographs.

Table 27
The Exhibit Type Preferences of Gregorc's Learning Styles: Expected Relationships and Regression Analyses Results for the General Audience and Conservation Trail Samples

Exhibit Type	Style Expected to "Like" the Exhibit	Actual Findings[a]
Signs telling facts about the animals	AS	-----
Signs asking questions which you lift/turn for the answer	CS	AS did not like
Displays giving issue overviews by presenting the conflicting views	AR / AS	M: ----- F: -----
Exhibits which allow you to try your skills and experiment	CR	AS did not like
Displays with touchable items	CS / CR	AS did not like
Displays with silent videos or photographs	AR	-----
Displays with recordings of information that you can hear	AS	AS did not like

Note. The word "like" is used in place of "find more appealing." M=Males; F=Females. Dashes indicate that no learning style was a significant predictor of preference for the exhibit type.
[a]N=101; M:n=30; F:n=71.

Decision-making at the Zoo

The survey also asked participants to rate five items as to how important each was in deciding which exhibits to visit (refer to Table 21). No differences appeared among Kolb's learning styles or among Gregorc's styles regarding the importance of the various factors. One difference was found, however, among Kolb's primary learning modes. "Reflective Observers" tended to rate the directional signs located along the paths as less important than the other three learning mode groups, $F(3,91)=2.23$, $p=.0902$. Moreover, of those participants visiting with children, females, in contrast to males, rated the interests of the children in their group as more important in deciding which zoo exhibits to view, $F(1,117)=4.13$, $p=.0443$.

Admission Fees for New Exhibits

The last survey item described a new exhibit being planned and asked the respondents to choose the maximum amount they would be willing to pay to enter it. The Conservation Trail participants were asked only about Congo Forest, the new gorilla exhibit, because that is the exhibit which was described to them once they approached inquiring specifically about the sign they had seen advertising a gorilla. Half of the General Audience was asked about Congo Forest; the other half was asked about the Rare Bird Conservation Hub, an exhibit providing a behind-the-scenes look at breeding research for endangered species. The price options ranged from "less than $.50" to "more than $5," generally in increments of one dollar.

This question was asked for three basic reasons. First, there were practical concerns. Due to its limited capacity, Congo Forest will require a crowd-control measure. The intent of this survey item was to ascertain the proportion of visitors who would opt to enter the gorilla exhibit given various admission fees. For the Rare Bird Conservation Hub, similar information was desired because this exhibit will need to attain sufficient funds to remain self-supporting. The second reason for this survey question was to compare the responses to these two very different exhibits. In other words, would gorillas, a more popular zoo attraction, evoke greater interest and willingness to pay than the bird exhibit. Thirdly, this question enabled comparison of "random" survey participants' responses elicited by a verbal description of the exhibit to the responses given by those visitors who were attracted by a sign advertising the entrance fee. That is, how does what people say they will pay relate to their behavior when the price is already stated?

Regardless of the exhibit (Congo Forest or Rare Bird Hub), the admission charge participants would be willing to pay was not influenced by their gender, age, or education. However, respondents visiting alone or with only one companion were willing to pay a higher entrance fee (n=74, M=$2.35, SD=1.23) than were those with two or more companions (n=126, M=\$1.95, SD=1.29), $F(1,198)=5.02$, $p=.0262$.

Despite the differences in group size and composition between the GA and CT samples, the mean price both groups would be willing to pay to enter the new Congo Forest (gorilla) exhibit was approximately \$2.00 per person (see Table 28).

Table 28
Willingness of the General Audience and the Conservation Trail Participants to Pay Various Entrance Fees for the Congo Forest Exhibit

	Visitor Group			
Entrance Fee	General Audience (n=50)		Conservation Trail (n=100)	
<=\$.50	5	10%	8	8%
\$1.00	13	26%	20	20%
\$2.00	21	42%	37	37%
\$3.00	6	12%	21	21%
>=\$4.00	5	10%	14	14%
M[a]	\$1.93		\$2.28	

Note. No significant difference between the two samples, $F(1,148)=2.72$, $p=.1015$.
[a]To calculate dollar means from the categorical data, "less than \$.50" was set to "\$.00" and "more than \$5" was set to "\$6.00."

Within the Conservation Trail group however, four differences in entrance fees existed. CT respondents visiting without children were willing to pay a higher fee (n=52, M=\$2.53, SD=1.39) to enter the Congo Forest exhibit than were those accompanied by children (n=48, M=\$2.01, SD=1.16), $F(1,98)=4.06$, $p=.0467$. (Within the GA sample, no price difference appeared with respect to the presence/absence of children.) Of the CT respondents visiting the zoo with children, men were willing to pay a higher admission charge than women, $F(1,46)=3.08$, $p=.0859$. Moreover, price differed by average number of annual zoo visits. Those visiting less than once a year reported a willingness to pay more, $F(3,96)=2.50$, $p=.0643$. Whereas these infrequent visitors would be willing to pay approximately \$3.00, those visiting a zoo more often would pay only \$2.00. Within this group, price also differed between BZ/WCS members and non-members, with a greater portion of non-members willing to pay more (see Table 29).

In the General Audience there were not enough BZ/WCS members to make such a comparison. Rather, a comparison was made concerning the price General Audience visitors would be willing to pay to enter the proposed Congo Forest exhibit (N=50; M=\$1.93; SD=1.138) as compared to the proposed Bird Conservation Hub (N=50; M=\$1.90; SD=1.340). No difference in price distribution was detected between these two exhibits (see Table 30).

Table 29

Willingness of BZ/WCS Members and Non-members at the Conservation Trail to Pay Various Entrance Fees for the Congo Forest Exhibit

	Bronx Zoo/Wildlife Conservation Society Membership Status			
Entrance Fee	Member (n=39)		Non-member (n=61)	
<=$.50	6	15%	2	3%
$1.00	13	33%	7	11%
$2.00	12	31%	25	41%
$3.00	5	13%	16	26%
>=$4.00	3	8%	11	18%
M^a	$1.79		$2.59	

Note. $F(1,98)=10.24$, $p=.0019$.

[a]To calculate dollar means from the categorical data, "less than $.50" was set to "$.00" and "more than $5" was set to "$6.00."

Table 30
Willingness of General Audience Participants to Pay Various Entrance Fees for the Congo Forest Exhibit Compared to the Bird Conservation Hub

	New Exhibit			
Entrance Fee	Congo Forest (gorillas) (*n*=50)		Bird Conservation Hub (*n*=50)	
<=$.50	5	10%	4	8%
$1.00	13	26%	18	36%
$2.00	21	42%	18	36%
$3.00	6	12%	6	12%
>=$4.00	5	10%	4	8%
M[a]	$1.93		$1.90	

Note. No significant difference between the two exhibits, $F(1,98)=0.01$, $p=0.9411$.
[a]To calculate dollar means from the categorical data, "less than $.50" was set to "$.00" and "more than $5" was set to "$6.00."

The Baboon Reserve (BR) Participants

The analysis of the Baboon Reserve survey examined the demographic variables and the learning styles of the participants and how these characteristics related to their behavior at the exhibit, their ratings of the exhibit components, and their so-called "cognitive gain" from the experience. Whereas each learning style/mode typology could be examined using only half of the sample (i.e., those who completed the relevant instrument: LSI or GSD), the effects of the demographic factors were examined across the entire sample ($\underline{N}$=110).

Background Characteristics

By contrast to the GA and CT groups, no significant relationship appeared between learning style/mode and gender for either the Kolb or the Gregorc typology (see Table 31). Nor did any differences appear among the learning styles/modes with respect to the age, education, frequency of zoo visits, or BZ/WCS membership status of the participants. Neither did gender nor learning style, for the most part, relate to whether one was visiting the exhibit[24] with or without a

[24]Please note the distinction between visiting the exhibit (i.e., the one display under observation) and visiting the zoo. A visitor group did not always remain intact while touring the Baboon Reserve or the Himalayan Highlands: Some group members might proceed to further displays; others might lag behind. The concern here is with a participant's companions while at the one exhibit, as this could influence

child or an adult companion. The one exception was among Gregorc's learning styles. Concrete-Randoms were more likely than Concrete-Sequentials or Abstract-Randoms to be visiting the exhibit with no adult companion, $\underline{F}(3,45)=2.63$, $\underline{p}=.0615$.

Behavior at the BR Display

While at the exhibit, visitors were observed looking at exhibit components, reading graphics aloud, talking with an adult or a child, showing something to an adult or child, watching someone manipulate an exhibit component, or manipulating it themselves alone, with an adult or with a child. (For the operational definitions of these behaviors, see Appendix P.) These behaviors took place in relation to four text panels, telescopes, participatory "liftable" question panels, mounted ibex horns, a glass-enclosed bulletin board, or the live animals. The number of occurrences of each behavior were summed (e.g., the participant "talked with a child" two times) and the number of behaviors associated with each component were summed (e.g., three behaviors were carried out in relation to the ibex horns). Thus, a total for each behavior and for each exhibit component was calculated.[25]

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the behaviors observed by the researcher.

[25]The raw frequencies of observed behaviors, rather than percentages, were utilized in this analysis because no differences in total frequency of behaviors appeared among Kolb's learning styles, $\underline{F}(3,51)=1.31$, $\underline{p}=0.2819$; Kolb's learning modes, $\underline{F}(3,48)=0.61$, $\underline{p}=0.6121$; or Gregorc's learning styles, $\underline{F}(3,45)=0.77$, $\underline{p}=0.5169$.

Table 31
Distribution of Learning Styles/Modes Within Each Gender for the Baboon Reserve Participants

Kolb's Learning Styles	Gender: Female		Male		Total	
Diverger	12	35%	3	14%	15	27%
Assimilator	16	47%	15	71%	31	56%
Converger	2	6%	2	10%	4	7%
Accommodator	4	12%	1	5%	5	9%
Total	34	100%	21	100%	55	100%

$X^2(3, \underline{N}=55)=4.406$, $\underline{p}=0.221$

Kolb's Learning Modes	Female		Male		Total	
Concrete Experience	3	9%	0	0%	3	6%
Reflective Observation	11	34%	7	35%	18	35%
Abstract Conceptualization	11	34%	5	25%	16	31%
Active Experimentation	7	22%	8	40%	15	29%
Total	32	100%	20	100%	52	100%

$X^2(3, \underline{N}=52)=3.630$, $\underline{p}=.304$

Gregorc's Learning Styles	Female		Male		Total	
Concrete-Sequential	9	45%	13	45%	22	45%
Abstract-Sequential	5	25%	8	28%	13	27%
Abstract-Random	4	20%	2	7%	6	12%
Concrete-Random	2	10%	6	21%	8	16%
Total	20	100%	29	100%	49	100%

$X^2(3, \underline{N}=49)=2.518$, $\underline{p}=0.472$

Note. Because of the small sample sizes Chi-square may not be a valid test.

Of the total sample (N=110), 13% read aloud from one of the textual exhibit components, 79% talked with companions about the exhibit, 55% "showed" an exhibit component or a live animal to a companion, and 73% manipulated some participatory component.

More specifically, 57% of the respondents talked to an adult companion while at the exhibit, most often about the live animals, but also about the text panel on the far right (about ibex), the panel on the far left (about hyraxes), or the ibex horn replicas. Thirty-three percent talked with children, usually about the live animals, the telescopes, or the ibex horn replicas. Thirty-two percent of the participants were observed "showing" part of the exhibit to an adult; thirty percent "showed" things to children. The live animals, of course, were the object of most of the finger-pointing and "Look!" exclamations. By themselves, 52% of the respondents manipulated some exhibit component, most often a telescope. Twenty-one percent manipulated a component with an adult, thirty percent with a child, and forty-two percent watched another person doing the manipulation. (See Tables 32 and 33 for more specifics on the frequencies of the observed behaviors.)

Analyses were then conducted to uncover relationships between these behaviors and demographic characteristics, as well as learning style.

Table 32
Frequencies of Visitor Behaviors Observed at the Baboon Reserve

Exhibit Component	Look	Read Aloud	Talk With Adult	Talk With Child	Show Adult	Show Child
Far left text panel about hyraxes	64%	2%	12%	1%	2%	0%
Middle left text panel about geladas	55%	0%	3%	1%	0%	0%
Middle right text panel about baboons	66%	1%	2%	2%	0%	1%
Far right text panel about ibex	76%	3%	15%	3%	1%	1%
Telescope	--[a]	--[b]	7%	16%	4%	5%
Participatory lift panels	56%	7%	2%	0%	2%	3%
Mounted ibex horn replicas	46%	3%	12%	12%	5%	5%
Bulletin board	65%	0%	4%	1%	1%	0%
Live animals	--[a]	--[b]	43%	20%	23%	27%

Note. N=110.
[a]Observations were not made of "looking" at the telescopes or the live animals. [b]There was no written text located on the telescopes or the live animals that could be "read aloud."

Table 33
Frequencies of "Manipulation" Behaviors Observed at the Baboon Reserve

Exhibit Component	Manipulate			Watch Someone Manipulate
	Alone[a]	With Adult[b]	With Child[c]	
Telescope	28%	6%	21%	25%
Participatory lift panels[d]	26%	15%	9%	16%
Mounted ibex horn replicas	11%	6%	10%	6%
Lift panel for ibex horns	9%	4%	8%	9%

Note. *N*=110.
[a]Participant manipulated the component by him/herself, while companions were elsewhere at the exhibit. [b]Participant manipulated the component while accompanied by an attentive adult. [c]Participant manipulated the component while accompanied by an attentive child. [d]The percentages represent the portion of individuals who "lifted" at least one of the six panels.

In order to examine the behaviors solely in relation to demographic characteristics, the behaviors were first factor analyzed. This analysis (*n*=108) resulted in four distinct factors: (1) a child-orientation, (2) an adult peer-orientation, (3) a self-orientation, and (4) a single behavior, watching others manipulate exhibit components (see Table 34). The only correlation among these four factors was a weak negative one (*r*= -.19) between the child-oriented and the adult peer-oriented behaviors (see Table 35).

Table 34
Factor Structure for Behaviors Performed at the Baboon Reserve

Observed Behavior	Abbreviation
1. "Show" child	Show-C
2. Manipulate display with child	Manip-C
3. Talk with child	Talk-C
4. Read aloud	Read
5. "Show" adult companion	Show-A
6. Manipulate display with adult	Manip-A
7. Talk with adult companion	Talk-A
8. Manipulate display while alone	Manip
9. Look at a display	Look
10. Watch someone else manipulate a display	Watch

Factor 1 Child-Oriented		Factor 2 Adult-Oriented		Factor 3 Self-Oriented		Factor 4 Watch Others Manipulate	
Show-C	.788						
Manip-C	.759						
Read	.740						
Talk-C	.658						
		Show-A	.744				
		Manip-A	.678				
		Talk-A	.623				
				Manip	.870		
				Look	.656		
						Watch	.844

Note. n=108.

Table 35
Intercorrelations Between Behavior Factors for the Baboon Reserve

Behavior Factor	1	2	3	4
1. Child-oriented	--	-.19	-.02	.01
2. Adult-oriented		--	.05	.13
3. Self-oriented			--	.05
4. Watch others manipulate				--

Note. n=108.

Each of these four factors was then entered into a stepwise regression equation with the following independent or "predictor" variables: gender, age, education, number of annual zoo visits, BZ/WCS membership,[26] and visiting the specific BR exhibit under observation with or without children and with or without adult companions.

Considering only those visitors accompanied by children, the child-oriented behaviors[27] were more likely to be

[26]Even though only 9% (n=10) of the BR sample were members, this variable was included in the analyses of background characteristics because of its potential significance to leisure research and zoo marketing efforts.

[27]Because the performance of these behaviors required the presence of a child, the predictor variable indicating whether the participant was visiting the BR exhibit with or without children was omitted from this regression equation due to its irrelevance.

performed by BZ/WCS members, by females, and by those participants visiting the exhibit without adult companions.

Among visitors accompanied by adults, the adult peer-oriented behaviors[28] were more likely to be performed by participants visiting the exhibit without children and by those who visit zoos less frequently.

The older participants were, the more likely they were to engage in the self-oriented behaviors (i.e., looking at exhibit components and manipulating them by oneself[29]).

Males and participants visiting the exhibit with children were more likely to watch others manipulate exhibit components.

With regard to gender specifically, males and females did not differ in the total number of behaviors they performed in relation to each of the exhibit components. Nor did they differ with respect to manipulating exhibit components by themselves or communicating with adult companions. However, two differences did appear regarding the gender of the participant. Across the entire sample ($\underline{N}$=110), men were more often than women observed watching another person manipulate an exhibit component, $\underline{F}(1,108)=3.86$, $\underline{p}=.0521$. Considering

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[28]Because the performance of these behaviors required the presence of another adult, the predictor variable indicating whether the participant was visiting the BR exhibit with or without an adult companion was omitted from this regression equation due to its irrelevance.

[29]Whereas the participants may have had companions at the exhibit, they were alone when engaged in the manipulating.

only those participants who were visiting the exhibit with a child, women were more likely than men to engage in child-oriented behaviors.

Because the investigation of learning styles is theory-driven, each of the behaviors was examined individually in relation to style. Even though some of the learning style categories have very few representatives,[30] findings concerning the observed behaviors of the various learning styles will be reported here if only to suggest areas for further research.[31]

Considering Kolb's typology, there were no differences among styles in number of behaviors associated with the text panels, the telescopes, the lift questions, the bulletin board, or the live animals. However, as would be expected, Convergers ($\underline{n}$=4) on average, performed more behaviors associated with the mounted ibex horns than did the other three styles, $\underline{F}(3,49)=3.05$, $\underline{p}=.0371$. In addition, whereas the styles did not differ in looking at the exhibit components, reading aloud, "showing" companions, or manipulating

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[30]Two learning styles in each typology had very small $\underline{n}$s: Kolb's Convergers ($\underline{n}$=4; 7% of LSI sample) and Accommodators ($\underline{n}$=5; 9% of LSI sample) and Gregorc's Abstract-Randoms ($\underline{n}$=6; 12% of GSD sample) and Concrete-Randoms ($\underline{n}$=8; 16% of GSD sample).

[31]Please note that the performance of some of the behaviors required being with another person. More specifically, some required being with an adult (e.g., "talking with an adult") and some required the presence of a child. Hence, the analyses of the various behaviors were performed employing only that portion of the sample that satisfied these requirements.

components alone (contrary to expectations), two differences in behaviors were found to exist. First, those Convergers visiting the exhibit with another adult (n=3) talked more frequently with their adult companion than did the other learning styles, $F(3,39)=4.78$, $p=.0062$. Second, of those respondents visiting the exhibit with a child (n=32), Accommodators (n=2), on average, manipulated exhibit components with their children more frequently (in accordance with theory) than did Kolb's other styles, $F(3,28)=4.51$, $p=.0105$.

Among Kolb's learning modes, no differences appeared in total number of each of the various types of behaviors (e.g., talking, showing, manipulating) or total behaviors associated with each of the exhibit components (e.g., the text panels, the telescopes, the lift questions).

In keeping with Gregorc's typology, of those participants visiting the exhibit with a child (n=27), Abstract-Randoms (n=3), on average, manipulated exhibit components with their children more frequently than did the other learning styles, $F(3,23)=2.85$, $p=.0596$.

Length of Stay

The length of time spent at the Baboon Reserve exhibit was similar for males and females, for all of Kolb's learning styles and modes, and for all of Gregorc's styles. For the overall sample, the average amount of time spent at the exhibit was three minutes (N=105, M=185.210 seconds, SD=81.717), with the briefest visit lasting only one minute and the lengthiest seven. The presence of a child, however, did have an impact. Those respondents visiting the exhibit with a child (n=58) tended to stay longer than those without children (n=47), $F(1,103)=4.93$, $p=.0285$. Older individuals and more educated visitors tended to stay longer also.

Best Liked Parts of the BR Display

On the Baboon Reserve survey, participants were asked two open-ended questions. First, "NOT including the live animals, which part of the display did you like best?" Responses to this inquiry were content-analyzed. Each of the exhibit components emerged among the content categories except for the bulletin board. Across the entire sample (N=110), the most popular response related to the scenery or natural environment of the exhibit; the second-most frequent answer referred to the signs (see Table 36). (See Appendix Q for the individual verbatim responses included in each content category.)

The following differences appeared when these responses were examined in relation to gender (females: n=59; males: n=51). A larger portion of females than males considered the signs to be the best part of the display, $F(1,108)=4.11$, $p=.0452$. By contrast, a larger portion of men replied that they liked the design of the exhibit best, $F(1,108)=6.30$, $p=.0136$. In fact, no women made this specific response.

Further, all of the men who did were visiting with children, $F(3,106)= 6.06$, $p=.0008$. In addition, men were more likely than women to provide a miscellaneous comment (i.e., a response which could not be classified into one of the established categories), $F(1,108)=3.54$, $p=.0627$.

Table 36
The Best Liked Parts of the Baboon Reserve Exhibit

Display Component	Freq	%
Scenery/natural environment/ physical surroundings	33	30%
Signs	22	20%
Participatory lift panels	16	14.5%
Information in general	16	14.5%
Telescope	8	7%
Mounted ibex horns	7	6%
Design of exhibit	5	4.5%
The live animals[a]	3	3%
Miscellaneous reply	7	6%

Note. Percentage may total more than 100 as a participant's response could include more than one category.
[a]Given that a primary reason people visit a zoo is to see animals, the low frequency in this category may seem odd. However, the question read, "NOT including the live animals, which part of the display did you like best?"

Again, despite the small *ns*, findings associated with learning styles will be reported here. Within Kolb's typology, Accommodators were more likely than the other three styles to state that they liked best the telescopes, $F(3,51)=2.30$, $p=.0886$. Kolb's modes, on the other hand, did not differ from one another in the content of the responses they proffered regarding what they liked best about the exhibit. Among Gregorc's styles, Abstract-Randoms were more likely than the Abstract-Sequentials and the Concrete-Sequentials (and the Concrete-Randoms were more likely than the Abstract-Sequentials) to volunteer that the natural surroundings were the best part of the display, $F(3,45)=2.21$, $p=.0994$.

What Visitors Believed They Learned

Next, participants were asked, "Did you learn anything from the display?" They responded by circling "YES" or "NO." Ninety respondents (82%) reported that they did learn something, eighteen (16%) answered "No," and two individuals (2%) made no response. The answers of females (visiting with or without children) did not differ from those of males (with or without children), nor was there any difference among the responses of Kolb's or Gregorc's learning styles. There was a difference, however, among Kolb's learning modes. Active Experimenters were more likely than the other modes to report that they did not learn anything from the display, $F(3,48)=2.92$, $p=.0435$.

That question was followed by, "If YES, what did you learn?" and "If NO, was there a reason that you didn't learn anything?" (See Appendixes R and S for the individual verbatim responses to these two questions.) The responses indicating what was learned were content-analyzed into categories, each of which designated the exhibit component from which the information came (see Table 37). For instance, nearly 25% of the respondents mentioned information which was contained on the participatory lift panels.

Examining these responses in relation to gender, no differences appeared. However, investigating any possible interaction effects between gender and the presence/absence of children produced one significant result. In contrast to women visiting with children and to all men (i.e., with or without children), women without children were more likely to provide information (whether correctly interpreted or not) gathered from the textual signs, $F(3,106)= 2.31$, $p=.0803$.

With respect to learning styles, only one difference appeared. Gregorc's Abstract-Sequentials were more likely than his other styles to state a misinterpretation of a sign's textual message, $F(3,45)=2.22$, $p=.0992$.

Table 37
The Exhibit Components from Which Baboon Reserve Participants Learned

Display Component	Freq	%
Participatory lift panels	27	25%
Textual signs	28[a]	26%[a]
A. Information interpreted as intended	(20)	(18%)
B. Misinterpretation of message[b]	(8)	(7%)
Mounted ibex horns	12	11%
The live animals	7	6%
Miscellaneous response[c]	26	24%

Note. Percentage represents the portion of the total sample that gave the reply (i.e., N=110; individuals who did not answer and those who responded that they did not learn anything are included here).
[a]The portions contributed by "correct" interpretations (A.) and misinterpretations (B.) are displayed in parentheses.
[b]This category represents the responses of individuals who interpreted information located on the signs in a manner other than was intended. [c]This category represents all responses which could not be designated as having come from a specific exhibit component.

The reasons given for not learning were also content-analyzed (see Table 38). There was one difference between the genders. All of the responses to the effect that no live animals were seen came from females, $F(1,108)=4.64$, $p=.0335$. When responses were explored for any interaction effects between gender and visiting with or without children, no differences appeared. Likewise, there were no differences among Kolb's or Gregorc's learning styles. The following, however, appeared among Kolb's learning modes. The three individuals who indicated that they did not learn anything because they "did not read" were all Active Experimenters, $F(3,48)=2.85$, $p=.0473$.

Table 38
Reasons Given by Baboon Reserve Participants for Not Learning Anything

Reason	Freq	%
No live animals were visible	5	5%
I was with a child	4	4%
I didn't read	4	4%
I already knew the information	3	3%
Miscellaneous reason for not learning	3	3%

Note. Percentage represents the portion of the total sample ($N=110$) who gave the reply.

Exhibit Component Preferences

The survey then asked visitors to rate five of the Baboon Reserve exhibit components on a scale from "very unappealing" ("1") to "very appealing" ("6"), giving the item a "0" if they did not look at it. The participatory lift panels received the highest rating; the bulletin board the lowest (see Table 39). The telescopes received the greatest number of "0" ratings; nearly one third (32%) of the participants reported that they "did not look" at them.[32]

In order to examine preferences for these five exhibit components in relation to demographic characteristics, the components were first factor analyzed.[33] This analysis (n=46) resulted in two factors: (1) textual exhibits and (2) hands-on exhibits (see Table 40). These two factors were not correlated (r= -.08).

The hands-on factor is interesting in that its two constituent displays (i.e., the telescopes and the touchable ibex horns) are inversely related: In other words,

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[32]It cannot be assumed that an exhibit component was not looked at solely by choice due to the respondent's lack of interest. In some instances, the crowded conditions prevented visitors from noticing or interacting with displays. In fact, tallies were kept of the number of visitor groups passing through the exhibit during each participant's stay. For 31% of the participants, the exhibit was considered "crowded," as the researcher could not even enumerate the number of groups there.

[33]Only those individuals who rated the exhibit component from "1-6" were included in this factor analysis and the subsequent regression analyses. Those responding with "0" (i.e., "I did not look at" the display) were excluded, thus reducing the effective sample size.

participants who rate the telescopes more appealing also rate the horns less appealing and vice versa.

Table 39
"Appealingness" Ratings for Each of the Baboon Reserve Exhibit Components

Exhibit Component	Mean Rating[a]	SD	No. of Raters[b]	No. of "0" Responses[c]
Question panels which you lift to find the answers	5.04	1.16	n=85	n=24
Telescopes	4.61	1.24	n=74	n=35
Written messages on the signs	4.57	1.14	n=104	n=6
Horns that you could touch	4.55	1.02	n=91	n=18
Glass-enclosed bulletin board	3.73	1.41	n=93	n=17

Note. Rating scale: 6=very appealing, 5=appealing, 4=somewhat appealing, 3=somewhat unappealing, 2=unappealing, 1=very unappealing, 0=I did not look at it.
[a]The mean was calculated using only the ratings 1-6. [b]The number of individuals who responded using the ratings 1-6. [c]The number of individuals answering with "0" (i.e., reporting that they "did not look" at the exhibit component).

Table 40
Factor Structure of Exhibit Components at the Baboon Reserve

Exhibit Component	Abbreviation
1. The written messages on the signs	Text
2. The glass-enclosed bulletin board	Bulletin
3. The question panels which you lift to find the answers	Lifts
4. The telescopes	Telescope
5. The horns that you could touch	Horns

Factor 1 Textual Exhibits		Factor 2 Hands-on Exhibits	
Text	.904		
Bulletin	.775		
Lifts	.730		
		Telescope	.778
		Horns	-.681

Note. n=46. Inter-factor correlation = -.08.

The two factors were then regressed on the following eight demographic variables: gender, age, education, number of annual zoo visits, BZ/WCS membership, the length of time spent at the observed BR exhibit, and whether the participant was visiting it with or without children and with or without adult companions.

Textual exhibits (n=63) were found to be preferred by non-members, individuals who visit zoos more frequently, those who spend more time at the exhibit, and less-educated visitors. The hands-on composite (n=59) was related to less-educated individuals, those who spend more time at the exhibit, and those who visit zoos less frequently.

Because all of the "0" ratings were excluded from these analyses, the sample size for each factor was greatly reduced. For instance, the "0" ratings for the written messages on the signs, the "0" ratings for the bulletin board, and the "0" ratings for the participatory lift panels were all excluded from the textual exhibits factor. Hence, the sample size was less than for any of these three individual exhibit components alone. So as to diminish the amount of information lost and to provide a more detailed account of particular exhibit types, each of the five exhibit components was also regressed separately. By such disaggregation an interpretation of the hands-on exhibit factor might also benefit.

The significant results of the stepwise multiple regression for each of the exhibit components are as follows:
(1) The written messages on the signs (n=97) were preferred by non-members, by those who visit zoos more frequently, by individuals who spend more time at the exhibit, and by those not accompanied by another adult.
(2) The glass-enclosed bulletin board (n=86) appealed most to less-educated visitors, non-members, and those not visiting

with an adult companion.

(3) The participatory question lift panels (n=79) were preferred by those who visit zoos more frequently.

(4) The telescopes (n=69) were liked most by those visiting with children.

(5) The touchable ibex horns (n=87) were preferred by females, less-educated visitors, and individuals who spend more time at the exhibit.

To explore the effects of gender alone, a multivariate analysis of variance (MANOVA) was conducted for each of the two exhibit component factors. Males and females did not differ on their preference for textual exhibits. However, they did differ on their preference for the hands-on displays, $F(2,60)=2.96$, $p=.0592$. Females rated the mounted ibex horns as more appealing than did males, $F(1,61)=4.30$, $p=.0424$. Across the entire sample, the mean rating for females (n=47; M=4.79; SD=0.91) was "appealing," whereas the mean for males (n=44; M=4.30; SD=1.09) was only "somewhat appealing." The telescopes were rated equally appealing by both men and women. However, when a MANOVA was run to test the interaction effect of gender and the presence of a child, the following difference appeared. Females visiting without children tended to rate the telescopes less appealing than did females with children or any males (i.e., with or without children), $F(3,59)=2.67$, $p=.0558$.

The presence/absence of a child was related to other differences as well. For instance, participants visiting the exhibit without a child (n=47) were more likely to report that they "did not look" at the lift panels, $X^2(1,N=109)=4.713$, $p=.030$. Moreover, those accompanied by a child rated the telescopes as more appealing, on average, than did those visiting without a child. Whereas respondents visiting the exhibit with children (n=45, M=4.84, SD=1.17) tended to rate the telescopes "appealing," those not accompanied by children (n=29, M=4.24, SD=1.27) tended to rate them only "somewhat appealing."

From simple regression analyses, differences in preferences for the various exhibit components also were shown to exist among the learning styles. In accordance with theory, those in Kolb's Abstract-Conceptualization mode found the textual messages to be more appealing than those in the Active-Experimentation mode, $F(3,47)=2.44$, $p=.0762$. With regard to the "0" rating, Kolb's Accommodators were more likely than the other three learning styles to "not look at" the written messages, $F(3,51)=3.86$, $p=.0145$, or the bulletin board, $F(3,51)=6.24$, $p=.0011$. Similarly, Kolb's Active-Experimenters were more likely than the other three learning modes to report not looking at the bulletin board, $F(3,48)=3.88$, $p=.0145$. Likewise, Gregorc's Abstract-Randoms were more likely than the Abstract-Sequentials or the Concrete-Randoms to "not look at" the bulletin board, $F(3,45)=2.53$, $p=.0691$.

Stepwise multiple regression analyses also were conducted to examine the effects of learning style on exhibit type preferences. A procedure similar to that used with the GA and CT samples was followed. The background characteristics of gender, age, education, and number of annual zoo visits were entered into the regression equations. Whether the participant was visiting the observed Baboon Reserve exhibit with or without children and with or without adult companions were also entered, as was the length of time s/he spent at the exhibit. Again, only those participants who rated the exhibit component from "1-6" were included in these regression analyses.

To investigate Gregorc's learning styles and Kolb's learning modes, the actual scale scores (as continuous variables) from the GSD and the LSI respectively were included in the regression models as predictors. For Kolb's categorical learning <u>styles</u> however, only Divergers and Assimilators could be included in the regressions, as there were too few Convergers and Accommodators. (See Table 41 for a summary of the hypothesized relationships between learning style/mode and the five Baboon Reserve exhibit components, as well as the actual regression results.)

The regression analyses employing Kolb's Diverger and Assimilator styles resulted in no significant relationships between learning style and preference for certain exhibit types. Gender, however, was shown to be a significant

Table 41

Learning Styles and Exhibit Type Preferences: Expected Relationships and Regression Analyses Results for the Baboon Reserve Sample

Exhibit Component	Kolb's Mode Expected to "Like" the Component	Actual Findings	Gregorc's Style Expected to "Like" the Component	Actual Findings
Telescopes	AE / CE	(*n*=35) -----	CR	(*n*=34) CR did not like
Ibex horns that could be touched	AE / CE	(*n*=45) AE did not like CE liked	CS / CR	(*n*=42) -----
Liftable question panels	CE / AE	(*n*=39) AC liked	CS	(*n*=41) AS did not like CR did not like
Written messages on the signs	AC / RO	(*n*=51) AE did not like	AS	(*n*=47) -----
Glass-enclosed bulletin board	RO / AC	(*n*=46) AE did not like CE liked	AR / AS	(*n*=41) -----

Note. The word "like" is used in place of "find more appealing." Sample size for each component differed because visitors who rated the component "0" (i.e., "I did not look at it") were excluded. Dashes indicate that no learning style was a significant predictor of preference for the exhibit component.

indicator of preference for the touchable ibex horns. As previously reported, females tended to rate these horns as more appealing than did males. Due to the small sample size, regression analyses could not be run separately for males and females.

Among Kolb's modes, participants higher in Active-Experimentation tended to rate the written messages on the signs and the bulletin board less appealing, as would be expected. These same individuals also rated the touchable ibex horns as less appealing, contrary to predictions. In contrast, visitors scoring higher on the Concrete-Experience scale tended to prefer the touchable horns, as hypothesized. Yet these individuals also rated the bulletin board as more appealing, contrary to expectations. Those higher in Abstract-Conceptualization, unexpectedly, tended to prefer the participatory question panels. No learning mode was related to preference for the telescopes. (See Table 41.)

The regression analyses involving Gregorc's styles showed gender to be a significant factor in preference for the telescopes and the bulletin board. Males tended to rate both of these as more appealing than did females. Again, regression analyses could not be performed on males and females separately because of the small sample size.

Nonetheless, the regression results from the whole sample showed Gregorc's learning styles to be related to two types of displays. Visitors scoring higher on the Abstract-Sequential scale or higher on the Concrete-Random scale were more likely to find the participatory question panels less appealing. Contrary to predictions, those higher on Concrete-Random, rather than those lower on this scale, considered the telescopes less appealing. (Refer to Table 41.)

Knowledge Acquisition

The final six questions on the survey were intended to assess what, if anything, the visitor had learned at the Baboon Reserve exhibit. Each question related to the information provided on a different exhibit component (see Appendix H for a description of the BR interpretives). For instance, the correct answer to each of the first three questions could be found on one of the four text panels. The participants were asked to fill in the three blanks, choosing their answers from a list of six animals. Only one of these three questions was answered correctly by at least 50% of the respondents.[34] (See Table 42 for a complete list of the questions and their correct answers.)

The correct response ("Ethiopia") to the next question ("In what country might you see wild geladas?") could be found among the information on the bulletin board (as well as on the text panel discussing geladas and on the sign at the entrance

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[34]It should be noted that at times there were no animals visible in this exhibit. In such cases, it may have been more difficult for visitors to remember the animals' names, even if they had read the graphics, because there were no live animals, only illustrations, to attach to the labels.

Table 42
Knowledge-Acquisition Questions on the Baboon Reserve Survey: Frequencies and Percentages of Correct Responses

	Pts[a]	Freq	%
I. From the exhibit you just viewed[b],			
A. Which animal lives in single sex herds?			
Correct response: Ibex	1	36	33%
B. Which animal spends most of its time on rocks?			
Correct response: Hyrax	1	33	30%
C. Which animal is a specific type of baboon?			
Correct response: Gelada	1	66	60%
II. In what country might you see wild geladas?[c]			
Responses: A. No answer	0	63	57%
B. Incorrect answer	0	2	2%
C. Africa	1	29	26%
D. An African country, other than Ethiopia	1	4	4%
E. Ethiopia	2	12	11%
III. How can you tell the age of an ibex?			
Responses: A. No answer	0	48	44%
B. Incorrect answer	0	2	2%
C. Horns (size/length of)[d]	1	30	27%
D. (Counting) "rings" on horns[e]	1	30	27%
IV. True or False: Just like a person, a gelada will look you in the eye to be polite, smile to be friendly, turn its back to be rude, and yawn when sleepy.			
Responses: A. No answer	0	18	16%
B. True (incorrect answer)	0	33	30%
C. False (correct answer)	1	59	54%

[a]The number of points scored for the response. [b]For the first three questions, respondents were instructed to choose their answers from the following list of animals:
Baboon Hyrax Monkey Gelada Mountain Goat Ibex.
[c]Because this question asks for a country, Ethiopia is the best answer. The name of this exhibit, by the way, is the Ethiopian Baboon Reserve. [d]Correct response - general. [e]Correct response - specific.

to the Baboon Reserve). Although 41% got at least the right continent ("Africa"), most respondents could not answer this question (see Table 42).

Participants were then asked, "How can you tell the age of an ibex?" The answer to this came from the participatory lift panel associated with the touchable ibex horn replicas. Slightly more than half of the respondents answered this correctly to some degree (refer to Table 42). Those who could not answer may have been perplexed more by the word "ibex" than the rest of the question. Many visitors looked at the horn display assuming the animal was a mountain goat or an antelope.

The last question ("Just like a person, a gelada will look you in the eye to be polite, smile to be friendly, turn its back to be rude, and yawn when sleepy") was to be answered "True" or "False." The correct response ("False") was provided by the question and answer lift panels. Again, slightly more than half of the participants answered it correctly (refer to Table 42). A few visitors who read these panels, did not realize that they were to be lifted for the answers. Consequently, they could only guess at this last question.

No differences in frequency of correct answers appeared between genders for any of these questions alone. However, when a composite score was computed (i.e., correct responses were summed over the six questions[35]), males tended to answer more questions correctly than females, $\underline{F}(1,108)=4.64$, $\underline{p}=.0334$. There were no significant interaction effects between gender and the presence/absence of a child.

With respect to learning styles, three differences appeared. Kolb's Divergers were more likely than Assimilators to correctly answer the fill-in question with "gelada," $\underline{F}(3,51)=2.33$, $\underline{p}=.0856$. (No differences appeared among Kolb's four primary learning modes.) Contrary to predictions based on Gregorc's typology, Concrete-Randoms were more likely than the other three styles to correctly answer "In what country might you see wild geladas?" $\underline{F}(3,45)=3.57$, $\underline{p}=.0211$. In further contradiction of expectations, Concrete-Randoms answered more of the six questions correctly than did Gregorc's other three learning styles, $\underline{F}(3,45)=3.48$, $\underline{p}=.0234$.

[35]Except for the survey item "In what country might you see wild geladas?", each of the questions was scored either correct or incorrect. For each correct response, the participant received a score of "1." In the case of the "country" question, respondents were given a "2" for answering "Ethiopia" and a "1" for "Africa" or any other African country.

The Himalayan Highlands (HH) Respondents

The analysis procedure of the Himalayan Highlands survey data replicates that of the Baboon Reserve. The behavior of the participants at the HH exhibit, their ratings of the exhibit components, and the knowledge they gained from the experience were all examined in relation to their background characteristics and learning style.

Background Characteristics

Kolb's learning styles and learning modes and Gregorc's learning styles were not related to the age, education, number of annual zoo visits, or BZ/WCS membership status of the participant. Whereas gender also was not related to Kolb's or Gregorc's styles, gender was related to Kolb's learning modes (see Table 43). Abstract-Conceptualizers were more likely to be male than female, $F(3,46)=2.95$, $p=.0424$.

Visiting the zoo with children or visiting the specific observed exhibit with children or with adult companions did not differ according to one's gender. However, Kolb's Divergers (style) were more likely than the Assimilators or the Accommodators to visit the exhibit without adult companions, $F(3,53)=3.87$, $p=.0141$. Likewise, Kolb's Concrete-Experiencers (mode) were more likely than the other three modes to visit the exhibit without adult companions, $F(3,48)=2.32$, $p=.0869$.

Table 43
Distribution of Learning Styles/Modes Within Each Gender for the Himalayan Highlands Participants

Kolb's Learning Styles	Female		Male		Total	
Diverger	13	45%	6	23%	19	35%
Assimilator	9	31%	14	54%	23	42%
Converger	2	7%	4	15%	6	11%
Accommodator	5	17%	2	8%	7	13%
Total	29	100%	26	100%	55	100%

$X^2(3,\underline{N}=55)=5.471,\ \underline{p}=.140$

Kolb's Learning Modes	Female		Male		Total	
Concrete Experience	3	11%	0	0%	3	6%
Reflective Observation	11	41%	6	26%	17	34%
Abstract Conceptualization	4	15%	11	48%	15	30%
Active Experimentation	9	33%	6	26%	15	30%
Total	27	100%	23	100%	50	100%

$\mathbf{X^2(3,\underline{N}=50)=8.069,\ \underline{p}=.045}$

Gregorc's Learning Styles	Female		Male		Total	
Concrete-Sequential	16	39%	9	60%	25	45%
Abstract-Sequential	7	17%	2	13%	9	16%
Abstract-Random	16	39%	3	20%	19	34%
Concrete-Random	2	5%	1	7%	3	5%
Total	41	100%	15	100%	56	100%

$X^2(3,\underline{N}=56)=2.415,\ \underline{p}=.491$

Note. Bold type designates X^2 significant at $\underline{p}<.10$. Because of the small sample sizes Chi-square may not be a valid test.

Behavior at the HH Display

While at the exhibit, participants were observed performing the same behaviors as at the Baboon Reserve: looking at exhibit components, reading graphics aloud, talking with an adult or a child, showing something to an adult or child, watching someone manipulate an exhibit component, or manipulating it themselves alone, with an adult or with a child. (For the operational definitions of the behaviors, see Appendix T.)

At the Himalayan Highlands, these behaviors occurred in relation to the following four modules: (1) a "table" with three rotating panels giving different people's viewpoints concerning snow leopard conservation; (2) a table documenting the tracking of a snow leopard in the wild, including diary excerpts from the researcher and a touchable radio collar; (3) a table displaying a world map upon which are dispersed the conservation projects undertaken by Wildlife Conservation International (a division of the BZ/WCS); and (4) a hanging text panel with a quotation from Buddhist writings.

As with the Baboon Reserve observational data, the number of occurrences of each behavior were summed and the number of behaviors associated with each module[36] were summed. Thus,

[36]In this section the word "module" is used in contrast to "component" in order to distinguish an entire display (such as the snow leopard tracking table) from its constituent elements (e.g., the diary excerpts and radio collar).

a total was calculated for each behavior and for each exhibit module.[37]

As previously noted, the performance of some of the behaviors required being with a companion (e.g., "showing a child"). In the overall HH sample ($\underline{N}$=115), 62% of the participants ($\underline{n}$=71) viewed the observed exhibit with another adult; 38% ($\underline{n}$=44) were accompanied by a child.

At both the Baboon Reserve and the Himalayan Highlands, only three participants were visiting the zoo alone, which precluded their engaging in such behaviors. At the Himalayan Highlands however, participants' groups often disbanded. There were two apparent causes. Because the exhibit being evaluated was located down a set of four stairs, strollers were effectively prohibited. Hence, the adult companion of the respondent was often left watching the child away from the observed exhibit. In addition, because the exhibit included no live animals, other group members simply were not interested. Consequently, whereas there were only 7 individuals who visited the Baboon Reserve exhibit alone, at the Himalayan Highlands 25 visitors viewed the exhibit by themselves. The fact that a substantial portion of the sample visiting the observed HH exhibit was composed of "singletons"

[37]The raw frequencies of observed behaviors, rather than percentages, were utilized in this analysis because no differences in total frequency of behaviors appeared among Kolb's learning styles, $\underline{F}(3,53)=2.13$, $\underline{p}=.1079$; Kolb's learning modes, $\underline{F}(3,48)=1.11$, $\underline{p}=.3562$; or Gregorc's learning styles, $\underline{F}(3,52)=0.27$, $\underline{p}=.8485$.

should be kept in mind when reviewing the following behavior totals.

Of the total sample (N=115), 2% read aloud from one of the textual exhibit components, 36% talked with companions about the exhibit, 12% "showed" an exhibit component to a companion, and 67% manipulated some participatory component.

More specifically, 24% of the participants talked to an adult companion while at the exhibit and 13% talked with a child. In each case, the radio tracking collar was the most popular topic of conversation. Seven percent of respondents were observed "showing" part of the exhibit to adult companions; five percent "showed" something to children. Again, the radio collar was the object of most of the "showing." By themselves, 49% of the participants manipulated some exhibit component, most often a rotating panel. Twelve percent manipulated a component with an adult, seventeen percent with a child, and sixteen percent watched another person doing the manipulation. (See Tables 44 and 45 for more specifics on the frequencies of the observed behaviors.)

Except for participants manipulating exhibit components while alone, all of the behaviors were much less frequently observed at the HH display than at the Baboon Reserve exhibit.

Table 44
Frequencies of Visitor Behaviors Observed at the Himalayan Highlands

Exhibit Component	Look	Read Aloud	Talk with Adult	Talk with Child	Show Adult	Show Child
Table with three rotating panels giving conflicting viewpoints	95%	1%	8%	3%	1%	0%
Table with radio collar and diary excerpts	98%	1%	17%	11%	6%	5%
Table locating international conservation projects on a world map	89%	0%	4%	1%	0%	1%
Sign displaying Buddhist quote	57%	0%	1%	0%	0%	0%

Note. N=115.

Table 45
Frequencies of "Manipulation" Behaviors Observed at the Himalayan Highlands

Exhibit Component	Manipulate Alone[a]	Manipulate With Adult[b]	Manipulate With Child[c]	Watch Someone Manipulate
First rotating panel	29%	5%	14%	15%[d]
Second rotating panel	35%	8%	10%	
Third rotating panel	32%	6%	8%	
Radio collar	15%	5%	4%	4%

Note. N=115.
[a]Participant manipulated the component by him/herself, while companions were elsewhere at the exhibit. [b]Participant manipulated the component while accompanied by an attentive adult. [c]Participant manipulated the component while accompanied by an attentive child. [d]This percentage represents the portion of individuals who "watched someone manipulate" any of the three rotating panels.

Analyses were conducted to explore the relationships between observed behaviors and demographic characteristics, as well as learning style. The behaviors "reading aloud," "showing a child," and "showing an adult" have been excluded from this discussion as they so rarely occurred (i.e., only two, six, and eight observations respectively).

To examine the seven remaining behavior categories in relation to demographic variables, the behaviors were first factor analyzed. This analysis was conducted using the entire sample (i.e., N=115). It resulted in three factors similar to those found at the Baboon Reserve: (1) a child-orientation, (2) an adult peer-orientation, and (3) a self-orientation (see Table 46). These three factors were virtually uncorrelated (see Table 47). Because "watching others manipulate a display" loaded on two factors, for purposes here it will be regarded as its own construct.

Each of these three factors and the variable "watching others manipulate" was then entered into a stepwise regression equation with the same predictor variables used for the BR analysis: gender, age, education, number of annual zoo visits, BZ/WCS membership,[38] and visiting the observed HH exhibit with or without children and with or without adult companions.

Considering only those visitors accompanied by children, the child-oriented behaviors[39] were more likely to be performed by members, older individuals, and those visiting the exhibit without adult companions.

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[38]Even though only 10% (n=11) of the HH sample were members, this variable was included in the analyses of the background characteristics because of its potential significance to leisure research and zoo marketing efforts.

[39]Because the performance of these behaviors required the presence of a child, the independent variable indicating whether the participant was visiting the HH display with or without children was omitted from this regression equation due to its irrelevance.

Table 46
Factor Structure for Behaviors Performed at the Himalayan Highlands

Observed Behavior	Abbreviation
1. Talk with child	Talk-C
2. Manipulate display with child	Manip-C
3. Watch someone else manipulate a display	Watch
4. Talk with adult companion	Talk-A
5. Manipulate display with adult	Manip-A
6. Look at a display	Look
7. Manipulate display while alone	Manip

Factor 1 Child-Oriented		Factor 2 Adult-Oriented		Factor 3 Self-Oriented	
Talk-C	.814				
Manip-C	.733				
(Watch	.430)	(Watch	.544)		
		Talk-A	.682		
		Manip-A	.638		
				Look	.839
				Manip	.645

Note. N=115.

Table 47
Intercorrelations Between Behavior Factors for the Himalayan Highlands

Behavior Factor	1	2	3
1. Child-oriented	--	.07	-.06
2. Adult-oriented		--	-.06
3. Self-oriented			--

Note. N=115.

Among visitors accompanied by adults, those participants who were visiting the observed display without children tended to engage in the adult peer-oriented behaviors.[40]

The self-oriented behaviors were more likely to be performed by visitors who were not accompanied by children and also by those who were not accompanied by adults.

Females, older visitors, individuals visiting with children, and those visiting with adults were more likely to watch others manipulate exhibit components.

With regard to gender specifically, males and females did not differ in the total number of behaviors they performed in relation to each of the four exhibit modules. Nor did they

[40]Because the performance of these behaviors required the presence of another adult, the independent variable indicating whether the participant was visiting the HH display with or without an adult companion was omitted from this regression equation due to its irrelevance.

differ with respect to looking at the modules, interacting with children or adult companions, or manipulating the rotating panels and collar. In contrast to the Baboon Reserve however, females were observed watching another person manipulate an exhibit component more often than males.

Because the investigation of learning styles is theory-driven, each of the behaviors (rather than the factors) was examined individually in relation to style. As various behaviors (e.g., "talking with an adult") could be performed only by certain subsamples (e.g., those with adult companions) of the total HH sample, when these behaviors were examined according to learning style, some of the resultant style categories had very few representatives. Nonetheless, as with the Baboon Reserve sample, the findings concerning learning styles are reported here so as to suggest areas for further research.

Neither Kolb's styles nor modes nor Gregorc's styles differed in the number of behaviors associated with each of the four exhibit modules. Nor did they differ in manipulating the collar or rotating panels themselves or in watching others manipulate them.

Excluding singletons (n=46), Kolb's Divergers (n=13) were observed talking less frequently with companions than the Assimilators or Accommodators, $F(3,42)=3.34$, $p=.0280$. More specifically, of those respondents accompanied by adults (n=38), Accommodators (n=6) talked more frequently with their adult companions than did Divergers or Assimilators, $F(3,34)=2.29$, $p=.0958$. Of those with children ($n=20$), Assimilators ($n=9$) were the only learning style to talk with the children, $F(3,16)=3.67$, $p=.0349$.

Only three of Kolb's modes viewed the exhibit with children ($n=19$). Of these, Active Experimenters ($n=7$) were less likely to talk with the children than were the Abstract Conceptualizers, $F(2,16)=3.21$, $p=.0671$. Active Experimenters also manipulated exhibit components with the children less frequently than did the Abstract Conceptualizers or the Reflective Observers, $F(2,16)=7.02$, $p=.0065$.

No differences related to observed behaviors appeared among Gregorc's four learning styles.

Though some of the learning styles are generally expected to be more "hands-on," because there was little opportunity for active participation at this HH display, it is not surprising that few differences surfaced from among the styles.

Length of Stay

Across the entire sample, the average amount of time spent at the Himalayan Highlands exhibit was nearly 2 minutes ($N=106$, $M=108.094$ seconds, $SD=55.564$), with the briefest visit lasting only 23 seconds and the lengthiest 5.5 minutes. (Compare this with the three minute average at the Baboon Reserve exhibit, which has live animals.)

The length of time at the HH exhibit was similar for all of Kolb's styles/modes and for all of Gregorc's styles. Females (N=66, M=116.136 seconds, SD=47.515) however, tended to stay longer than males (N=38, M=96.158 seconds, SD=66.487), $F(1,102)=3.16$, $p=.0783$. Those who visit zoos more frequently and less-educated individuals tended to stay longer also. In contrast to the Baboon Reserve, the presence/absence of children viewing the HH exhibit with the participant did not influence the amount of time spent, regardless of the participant's gender.

Best Liked Parts of the HH Display

On the HH survey (as on the BR survey), participants were asked two open-ended questions. First, "Which part of the display that you just viewed did you like best?" Responses to this inquiry were content-analyzed. Each of the exhibit components emerged among the content categories. Across the entire sample (N=115), the favorite parts were the rotating panels and the radio tracking display (see Table 48). (See Appendix U for the individual verbatim responses included in each content category.)

When these responses were examined in relation to gender, only one difference appeared. Females were more likely than males to reply that they liked the diary excerpts best, $F(1,111)=4.51$, $p=.0359$. In fact, no males made this response. Further, the majority of the women who did were <u>not</u>

accompanied by children, $F(3,109)=2.61$, $p=.0555$. No other differences appeared in relation to gender or the interaction of gender and the presence of children.

There also were no differences in the content of the responses offered by Kolb's learning styles/modes or Gregorc's styles regarding what they liked best about the HH exhibit.

Table 48
The Best Liked Parts of the Himalayan Highlands Exhibit

Display Component	Freq	%
Three rotating panels describing various views on snow leopard conservation	39	34%
Display documenting the tracking of a snow leopard in the wild	32	28%
Information in general	18	16%
Natural surroundings of the exhibit	8	7%
Diary excerpts about tracking a snow leopard	7	6%
"Nothing"	5	4%
Sign about Buddhism	3	3%
World map	1	1%
Miscellaneous reply[a]	10	9%

Note. Percentage may total more than 100 as a participant's response could include more than one category.
[a]This group includes replies which could not be designated as referring to a specific component, as well as those which simply did not fit into one of the other established categories.

What Visitors Believed They Learned

Next, participants were asked, "Did you learn anything from the display?" They responded by circling "YES" or "NO." Of the total sample (N=115), 103 (90%) reported that they did learn something and 12 (10%) replied "No." The answers of females (visiting the exhibit with or without children) did not differ from those of males (with or without children), nor was there any difference among the responses of Kolb's learning styles/modes or Gregorc's styles.

As a follow-up, participants were asked, "If YES, what did you learn?" and "If NO, was there a reason that you didn't learn anything?" (See Appendixes V and W for the individual verbatim answers to these two questions.) The responses indicating what was learned were content-analyzed into categories, each of which designated the exhibit component from which the information came (see Table 49). For instance, 39% of the participants mentioned information which was provided by the rotating panels; 29% offered replies related to the display about the radio tracking of snow leopards.

Examining these responses in relation to gender produced one significant result. Females were more likely than males to state information related to the radio tracking display, $F(1,111)=3.38$, $p=.0689$. No differences appeared concerning the interaction of gender and visiting the exhibit with or without children.

Table 49
<u>The Exhibit Components from which Himalayan Highlands Participants Learned</u>

Display Component	Freq	%
Three rotating panels describing various views on snow leopard conservation	45	39%
Display documenting the tracking of a snow leopard in the wild	33	29%
World map	3	3%
Sign about Buddhism	1	1%
Miscellaneous response[a]	34	30%

<u>Note.</u> Percentage represents the portion of the <u>total</u> sample that gave the reply (i.e., <u>N</u>=115; individuals who did not answer and those who responded that they did not learn anything are included here).
[a]This category represents all responses which could not be designated as having come from a specific exhibit component.

When these same responses were analyzed with respect to learning styles, neither Kolb's styles nor modes differed from one another. Within Gregorc's typology however, Concrete-Sequentials were more likely than the other three styles to volunteer something they had learned from the radio tracking display, <u>F</u>(3,52)=2.62, <u>p</u>=.0608.

The reasons given for <u>not</u> learning also were content-analyzed (see Table 50). Of the four resultant categories, the one representing a general lack of interest in the exhibit had the highest frequency.

Table 50
Reasons Given by Himalayan Highlands Participants for Not Learning Anything

Reason	Freq	%
Not interested	8	7%
I already knew the information	5	4%
I was with a child	2	2%
Miscellaneous reason for not learning	2	2%

Note. Percentage represents the portion of the total sample (N=115) who gave the reply.

Considering these reasons for not learning in relation to gender, one difference appeared. Females were more likely than males to assert that they already knew the information that was being presented, $F(1,111)=3.13$, $p=.0798$. In fact, no men made this claim.

With respect to Kolb's typology, Accommodators were more likely than the other three styles to express their lack of interest in the exhibit, $F(3,53)=3.55$, $p=.0205$. No differences in reasons appeared among Kolb's learning modes or Gregorc's learning styles.

Exhibit Component Preferences

The survey then asked visitors to rate five of the Himalayan Highlands exhibit components on a scale from "very unappealing" ("1") to "very appealing" ("6"), giving the item a "0" if they did not look at it. In the overall sample (N=115), the rotating panels and the tracking device (i.e., radio collar) received the highest mean ratings; the sign with the Buddhist quote received the lowest (see Table 51). The sign with the quotation from Buddhist writings also received the greatest number of "0" ratings; nearly one third (30%) of the participants reported that they "did not look at it."[41]

As to whether the component was rated "0" (i.e., not looked at), there were no differences between genders, between respondents visiting with or without children, or among the four combinations of these two variables.

In order to examine preferences for the five HH exhibit components in relation to demographic characteristics, the components were first factor analyzed.[42] This analysis

[41]Unlike the BR enclosure, the HH alcove was never crowded. Hence, if respondents reported that they did not look at a component, it was simply due to being unaware of or uninterested in it. In fact, 44% of the participants viewed the HH exhibit without any other visitor groups walking through; 91% viewed it while no more than two other groups passed.

[42]As with the BR regressions, those individuals rating an exhibit component "0" (i.e., "I did not look at it") were excluded from these analyses, thus reducing the effective sample size.

Table 51
"Appealingness" Ratings for Each of the Himalayan Highlands Exhibit Components

Exhibit Component	Mean Rating[a]	SD	No. of Raters[b]	No. of "0" Responses[c]
Device used to track snow leopards	4.90	1.07	n=111	n=4
Rotating panels that tell the views of different people	4.88	1.07	n=111	n=4
Diary excerpts about tracking a snow leopard	4.47	1.14	n=109	n=6
World map listing conservation projects	4.08	1.17	n=102	n=13
Sign with the quotation from Buddhist writings	3.75	1.45	n=81	n=34

Note. Rating scale: 6=very appealing, 5=appealing, 4=somewhat appealing, 3=somewhat unappealing, 2=unappealing, 1=very unappealing, 0=I did not look at it.
[a]The mean was calculated using only the ratings 1-6. [b]The number of individuals who responded using the ratings 1-6.
[c]The number of individuals answering with "0" (i.e., reporting that they "did not look" at the exhibit component).

(n=70) resulted in two factors: (1) textual exhibits and (2) the snow leopard tracking module (see Table 52). These two exhibit-component factors were not correlated (r=.09). Because the world map loaded on both factors, for purposes here it will be considered its own construct: That is, it will not be included on either of the factors.

Table 52
Factor Structure of Exhibit Components at the Himalayan Highlands

Exhibit Component	Abbreviation
1. The sign with the quotation from Buddhist writings	Quote
2. The rotating panels which tell the views of different people	Views
3. The world map listing various conservation projects	Map
4. The diary excerpts about tracking a snow leopard	Diary
5. The device used to track snow leopards	Collar

Factor 1 Textual Exhibits		Factor 2 Tracking Display	
Quote	.836		
Views	.798		
(Map	.530)	(Map	.400)
		Diary	.846
		Collar	.774

Note. n=70. Inter-factor correlation=.09.

Stepwise multiple regressions were then conducted regressing these two factors on the following eight demographic variables: gender, age, education, number of annual zoo visits, BZ/WCS membership, the length of time spent at the observed HH exhibit, and whether the participant was visiting it with or without children and with or without adult companions.

Textual exhibits (n=70) were preferred by individuals who spend more time at the exhibit (similar to the BR) and by those who visit zoos less frequently (in contrast to the BR). The tracking module (n=95) was preferred by females, less-educated individuals, visitors who spend more time at the exhibit, and those who visit zoos more frequently.

As with the BR analysis, each of the five exhibit components was also regressed separately, in order to reduce the amount of information lost (due to the "0" ratings) and to provide details about specific exhibit types.

The significant results of the stepwise multiple regressions for the individual components are as follows:
(1) The world map listing various conservation projects (n=90) was preferred by older individuals, non-members, less-educated visitors, and those who spent more time at the exhibit.
(2) Females, less-educated visitors, and members were more likely to find the tracking device (i.e., radio collar) more appealing (n=99).
(3) The diary excerpts about tracking a snow leopard (n=97)

were preferred by females, older individuals, those who visit zoos more frequently, those visiting without children, those accompanied by adults, and visitors who spent more time at the exhibit.

(4) The sign with the quotation from Buddhist writings ($\underline{n}$=73) was preferred by older individuals, those visiting without children, and visitors who stayed at the exhibit longer.

(5) None of the demographic characteristics were related to preference for the rotating panels ($\underline{n}$=100).

To further address the effects of gender, a multivariate analysis of variance was run for each of the two exhibit component factors. Whereas the preferences of males and females were similar for the textual exhibit components, they differed for the snow leopard tracking module, $\underline{F}(2,102)=5.87$, $\underline{p}=.0039$. Females tended to rate both the tracking device, $\underline{F}(1,103)=3.47$, $\underline{p}=.0655$, and the diary excerpts, $\underline{F}(1,103)=11.43$, $\underline{p}=.0010$, as more appealing than did males.

A similar MANOVA procedure was used to assess the effects of visiting the display with or without children. In this case, no differences appeared in preferences for either of the exhibit component factors.

Next, the relationships between learning style/mode and preferences for the individual exhibit components (rather than the factors) were explored. Simple regression analyses demonstrated the following differences.

Contrary to expectations, Kolb's Convergers tended to rate the tracking device as less appealing than the other three styles, $F(3,52)=3.45$, $p=.0231$. Expectations were supported, however, among Kolb's learning modes: Reflective Observers found the sign with the Buddhist quote to be more appealing than did the Concrete Experiencers or the Active Experimenters and the Abstract Conceptualizers found it to be more appealing than did the Active Experimenters, $F(3,31)=2.68$, $p=.0638$.

Two differences appeared among Gregorc's learning styles. Compared to Abstract-Sequentials and Concrete-Randoms, Abstract-Randoms, in accord with expectations, were more likely to look at the sign with the Buddhist quote (i.e., less likely to rate it "0"), $F(3,52)=2.24$, $p=.0940$. In addition, Concrete-Randoms tended to rate the tracking device as less appealing than the other three styles, $F(3,49)=2.52$, $p=.0686$.

As with the GA/CT and BR samples, stepwise multiple regression analyses also were conducted to further examine the effects of learning style on exhibit type preferences. Once again, the background characteristics of gender, age, education, and number of annual zoo visits were entered into the regression equations. The length of time spent at the observed HH exhibit, as well as whether the participant was visiting it with or without children and with or without adult companions were also entered. As with the BR analysis, only those participants who rated the exhibit component from "1-6" were included in these regressions.

Again, to examine Gregorc's learning styles and Kolb's learning modes, the actual scale scores (as continuous variables) from the GSD and LSI respectively were included in the regression models. To investigate Kolb's typology, a dichotomous categorical variable was entered for each of the four learning styles. (See Tables 53 and 54 for a summary of the hypothesized relationships between learning style/mode and the five HH exhibit components, as well as the actual regression results.)

The results of the regression analyses showed preference for only one exhibit component to be related to Kolb's styles (see Table 53). Whereas Convergers were expected to find the tracking device more appealing than other styles, results indicated the opposite. As previously reported, Convergers tended to rate the touchable radio collar less appealing.

Gender was shown to be related to preference for the diary excerpts (as previously reported). However, due to the small sample size, regression analyses could not be performed separately for males and females.

Kolb's modes were found to be significantly related to preferences for three of the exhibit components (see Table 54). All of these relationships were consistent, in a sense, with expectations. Participants scoring higher on the Abstract-Conceptualization scale tended to find the tracking device less appealing. Those scoring higher on Active-Experimentation rated the diary excerpts less appealing. And

Table 53
The Exhibit Type Preferences of Kolb's Learning Styles: Expected Relationships and Stepwise Regression Analyses Results for the Himalayan Highlands Sample

Exhibit Component	Style Expected to "Like" the Component	Actual Findings
Rotating panels giving different people's views	Divergers/ Assimilators	(n=47) -----
Touchable radio tracking collar	Convergers	(n=48) Convergers did not like
Diary excerpts about tracking a snow leopard	Divergers	(n=46) -----
World map locating conservation projects	Assimilators	(n=44) -----
Sign with quotation from Buddhist writings	Divergers	(n=34) -----

Note. The word "like" is used in place of "find more appealing." Sample size for each component differed because visitors who rated the component "0" (i.e., "I did not look at it") were excluded. Dashes indicate that no learning style was a significant predictor of preference for the exhibit component.

Table 54
Learning Styles and Exhibit Type Preferences: Expected Relationships and Regression Analyses Results for the Himalayan Highlands Sample

Exhibit Component	Kolb's Mode Expected to "Like" the Component	Actual Findings	Gregorc's Style Expected to "Like" the Component	Actual Findings
Rotating panels giving different people's views	RO / CE	(n=47) -----	AR / AS	(n=53) -----
Touchable radio tracking collar	CE	(n=48) AC did not like	CS	(n=51) -----
Diary excerpts about tracking a snow leopard	RO / CE	(n=46) AE did not like	AR	(n=51) CR did not like
World map locating conservation projects	AC / RO	(n=44) -----	CS / AS	(n=46) -----
Sign with quote from Buddhist writings	RO	(n=34) RO liked	AR	(n=39) -----

Note. The word "like" is used in place of "find more appealing." Sample size for each component differed because visitors who rated the component "0" (i.e., "I did not look at it") were excluded. Dashes indicate that no learning style was a significant predictor of preference for the exhibit component.

visitors scoring higher on Reflective-Observation were the ones who most preferred the sign displaying the Buddhist quote. No learning modes were found to be related to preference for the rotating panels or the world map depicting locations of conservation projects. Gender, again, was shown to be related to preference for the diary excerpts.

The regression analyses demonstrated a relationship between Gregorc's styles and the preference for only one exhibit component (see Table 54). In keeping with predictions based on theory, participants scoring higher on the Concrete-Random scale tended to find the diary excerpts less appealing. No relationships were found to exist between learning style and preference for the rotating panels, the tracking collar, the world map display, or the sign with the Buddhist quote. Results indicated that females rated the world map more appealing than males. Again, because of the small sample size, regressions could not be conducted on the two genders separately.

Knowledge Acquisition

The final three questions on the survey were intended to assess what, if anything, the visitor had learned at the Himalayan Highlands exhibit. Each question was primarily related to the information provided on a different exhibit module (see Appendix I for a description of the HH interpretives). The responses were scored: "0" for no answer or an incorrect answer, "1" for a partially correct response, and "2" for a correct answer. (See Table 55 for the questions and frequencies of responses and Appendix X for the verbatim answers.)

The first question read, "Snow leopards are rarely seen. What device has allowed these animals to be studied in the wild?" The information necessary to answer this question came from the display that presented a mounted radio collar and discussed the tracking of snow leopards. Sixty percent of the participants answered this question correctly with some version of "collar" or "radio tracking" (see Table 55). Others (16%) were given partial credit for "tracking device," a term which may have been "lifted" from elsewhere on the survey, but showed some thought nonetheless.

The second question asked, "What was the name of the conservation organization mentioned on the signs?" The table displaying the world map was entitled "Wildlife Conservation International" and went on to discuss W.C.I. and the contributions of this organization to conservation. (In much less prevalent terms, "Wildlife Conservation International" was noted on the sign with the Buddhist quote and "George Schaller, WCI Conservationist" was listed on the rotating panels.) Sixty-three percent of the participants could not provide a response to this question (see Table 55). Eighteen percent answered correctly; only 2 of the 21 correct replies gave the name of the organization rather than the initials.

Table 55

Knowledge-Acquisition Questions on the Himalayan Highlands Survey: Frequencies and Percentages of Correct Responses

		Pts[a]	Freq	%
I. Snow leopards are rarely seen. What device has allowed these animals to be studied in the wild?				
Responses:	A. No answer	0	27	23%
	B. Incorrect answer	0	1	1%
	C. Tracking device	1	18	16%
	D. Radio tracking	2	7	6%
	E. Collar/radio collar/ tracking collar	2	62	54%
II. What was the name of the conservation organization mentioned on the signs?				
Responses:	A. No answer	0	72	63%
	B. Incorrect answer	0	17	15%
	C. Partially correct words or reversed initials	1	5	4%
	D. Correct initials: WCI	2	19	16%
	E. Correct title: Wildlife Conservation International	2	2	2%
III. What general message did you get from the rotating panels?				
Responses:	A. No answer	0	28	24%
	B. Incorrect answer	0	12	10%
	C. A correct specific point	1	20	17%
	D. The main point	2	42	37%
	E. The main point stated elsewhere on the survey	2	13	11%

Note. N=115.

[a]The number of points scored for the response; that is, a measure of the degree of correctness.

The last question was "What general message did you get from the rotating panels?" Full credit (i.e., 2 points) was scored for relating the main point of that display, either in response to this question or elsewhere on the survey. That is, some participants demonstrated their understanding of the rotating panels in their responses to the previous open-ended inquiries about what they liked best or what they learned at the exhibit. Because the goal of the cognitive questions was to investigate what knowledge visitors gained from experiencing the exhibit, the location on the survey at which they revealed their comprehension was irrelevant.

The main point conveyed by the rotating panel display, in its most basic terms, is the following: There are different sides/views of the snow leopard conservation issue. For a response to be considered correct, some form of this message was required. Twenty-four percent of the participants offered no reply to this question. On the other hand, 48% stated an "accurate" interpretation (refer to Table 55).

For none of these individual questions did differences in frequency of correct answers appear between genders, between participants viewing the exhibit with children and those without, or among the learning styles/modes. Even after the points for the three questions were summed to calculate a composite score, no differences in knowledge acquisition appeared among the various subgroups of visitors.

Summary of Results
From Across All Four Subsamples

Results Related to Learning Styles

All four learning styles from both Kolb's and Gregorc's typology could be distinguished among zoo visitors. The distribution in each case was quite unbalanced. It was consistent, however, across all four subsamples, which represented a variety of zoo locations. Learning style was not found to be related to an individual's age or educational level. It was, nonetheless, related to gender.

The following summary attempts to clarify the results associated with learning styles by categorizing them as "hits" (accordant with expectations based on theory), "misses" (discordant with expectations based on theory), "irrelevancies" (extrinsic to theory), and "absences" (unfulfilled expectations).

Kolb's Learning Styles

In the overall sample (N=213), Assimilators were most numerous (42%), Convergers were least (11%). Both of these categories tended to have more males than females. Divergers, on the other hand, were more likely to be female. Zoo visitors, as a group, scored lower on the Active-Experimentation scale. Hence, there were fewer Convergers and

Accommodators and more Assimilators and Divergers than in the normative group. Nonetheless, the intercorrelations of the scales supported Kolb's bipolar model.

Findings accordant with expectations based on Kolb's style theory.

Assimilators: This group rated exhibits which allow a person to experiment as less appealing than did the other styles. Females who were Assimilators preferred displays giving overviews of issues by presenting conflicting viewpoints.

Convergers: These participants performed more behaviors associated with the ibex horn replicas.

Accommodators: This style was more likely than the other three to volunteer that the telescopes were the best part of the BR display. Accommodators who were accompanied by children manipulated more exhibit components with the children than did the other three groups. Accommodators accompanied by adults talked more frequently with their adult companions than did either Divergers or Assimilators. Accommodators at the BR exhibit were most likely to <u>not</u> look at the written messages or the bulletin board. At the Himalayan Highlands, people having this style were more likely to express their lack of interest in the exhibit as a reason for not learning anything. Among females, Accommodators, on average, considered displays including silent videos or photographs to be less appealing than did the other styles. Among males, Accommodators were the style most likely to prefer exhibits with touchable items.

Findings discordant with expectations based on Kolb's style theory.

Assimilators: Among females, this group found signs telling animal facts to be less appealing than the other three styles.

Convergers: Compared to the other styles, this group considered the tracking device (i.e., radio collar) to be less appealing.

Findings extrinsic to Kolb's style theory.

Divergers: This group was more likely than Assimilators to answer the BR survey's fill-in question correctly with "gelada." Divergers were more likely than Assimilators or Accommodators to visit the HH exhibit without an adult companion.

Assimilators: These individuals tend to visit zoos more frequently than do Convergers or Accommodators. Female Assimilators were most likely to prefer displays with informational audio recordings. At the HH exhibit, only Assimilators were likely to talk with the children.

Convergers: At the BR exhibit, Convergers accompanied by an adult talked more frequently with their adult companion than did people with other styles.

Expectations absent from Kolb's style findings.

Accommodators or Convergers would have been expected to engage more frequently in manipulation of exhibit components by themselves. People with these two styles also were expected to find the telescopes more appealing.[43]

Kolb's Learning Modes

Concrete-Experiencers were more likely to be female than male. Abstract-Conceptualizers were more likely to be male.

Findings accordant with expectations based on mode descriptions.

Concrete Experience (CE): Those participants scoring higher on the CE scale rated the ibex horn replicas more appealing.

Reflective Observation (RO): Those scoring higher on the RO scale rated the sign with the Buddhist quotation more appealing. Among females, those scoring higher on RO were more likely to consider displays with touchable items less appealing. Those classified as Reflective-Observers found the sign with the Buddhist quote to be more appealing than did Concrete-Experiencers or Active-Experimenters.

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[43]The small sample size precluded a test of this hypothesis by stepwise multiple regression analysis.

Abstract Conceptualization (AC): Exhibits which allow a person to experiment and the tracking device (i.e., radio collar) at the HH display were rated less appealing by individuals scoring higher in AC. Among males, those scoring higher on the AC scale considered displays with touchable items to be less appealing. Abstract-Conceptualizers found the written messages on the signs at the BR exhibit and the HH sign with the Buddhist quote to be more appealing than did the Active-Experimenters.

Active Experimentation (AE): Participants scoring higher on AE rated the written messages on the BR signs, the bulletin board, and the diary excerpts less appealing. Among females, those scoring higher on AE considered displays giving overviews of issues less appealing. For males, those scoring higher on AE rated displays with silent videos or photographs less appealing. At the BR display, Active-Experimenters were more likely than the other three modes to <u>not</u> look at the bulletin board. They also were more likely to explain that they did not learn because they did not read.

<u>Findings discordant with expectations based on mode descriptions.</u>

CE: Those scoring higher on CE found the bulletin board at the BR exhibit to be more appealing. Among females, those scoring higher on the CE scale rated signs telling animal facts more appealing.

AC: The participatory BR question panels were considered more appealing by those scoring higher on the AC scale.

AE: Individuals scoring higher on AE found the ibex horn replicas less appealing.

Findings extrinsic to mode descriptions.

CE: Displays with informational audio recordings were considered less appealing by females scoring higher on the CE scale. Concrete-Experiencers were more likely to visit the HH exhibit without adult companions.

RO: Compared to the other three modes, Reflective-Observers rated the directional signs along the paths as less important in deciding which exhibits to visit.

AC: Displays with silent videos or photographs were rated more appealing by males scoring lower on AC and by females scoring higher on AC.

AE: At the BR exhibit, Active-Experimenters were more likely than the other three modes to report that they did not learn anything. At the HH display, Active-Experimenters accompanied by children talked with the children less frequently than Abstract-Conceptualizers and manipulated exhibit components with the children less frequently than Abstract-Conceptualizers or Reflective-Observers.

Expectations absent from Kolb's mode findings.

Active-Experimenters or Concrete-Experiencers would have been expected to engage more frequently in the manipulation of exhibit components by themselves. These groups also were expected to find the telescopes more appealing than the other modes.

Gregorc's Learning Styles

In the overall sample (N=199), Concrete-Sequentials were most numerous (41%), Concrete-Randoms were least (14%). Abstract-Randoms were more likely to be female than male.

Findings accordant with expectations based on Gregorc's theory.

AS: Exhibits which allow a person to experiment and displays including touchable items were considered less appealing by individuals scoring higher on the AS scale. In addition, those scoring higher in AS rated participatory question signs in general and the specific "liftable" ones at the BR exhibit to be less appealing.

AR: Abstract-Randoms were more likely than Abstract-Sequentials or Concrete-Sequentials to volunteer that the natural surroundings were the best part of the BR display. Abstract-Randoms accompanied by children tended to manipulate BR exhibit components with the children more frequently than the other three styles. At the HH exhibit, people with this style were more likely than the Abstract-Sequentials or the Concrete-Randoms to look at the sign with the Buddhist quote.

CR: Participants scoring higher on the CR scale rated the HH diary excerpts less appealing.

Findings discordant with expectations based on Gregorc's theory.

AS: Those scoring higher in AS rated displays with informational audio recordings less appealing.

AR: Abstract-Randoms were more likely than Abstract-Sequentials or Concrete-Randoms to not look at the BR bulletin board.

CR: Individuals scoring higher on the CR scale found the BR participatory question panels and telescopes less appealing. Concrete-Randoms tended to rate the HH tracking device less appealing than the other three styles. They were more likely to correctly respond that wild geladas could be found in Ethiopia. And they answered correctly more of the six questions on the BR survey than did any other style.

Findings extrinsic to Gregorc's theory.

CS: Concrete-Sequentials were more likely to volunteer information they had gathered from the radio tracking display in response to the question, "What did you learn?"

AS: Abstract-Sequentials at the BR exhibit were more likely to state a misinterpretation of a textual message as evidence of what they had learned.

CR: Concrete-Randoms were more likely than Concrete-Sequentials or Abstract-Randoms to visit the BR exhibit with no adult companions.

Expectations absent from Gregorc's style findings.

Abstract-Sequentials were expected to find the textual components more appealing than the other styles. Concrete-Sequentials or Concrete-Randoms were expected to find the touchable ibex horns more appealing and to engage more frequently in manipulation of exhibit components by themselves.

Results Related to Demographic Characteristics

Exhibit Type Preferences

The following specific display components and exhibit-type composites are presented along with the subsample from which they came and the various visitor segments likely to find them appealing.

Textually-oriented exhibits.

GA/CT textual exhibits:

individuals who visit zoos more frequently
those visiting without adult companions.

BR written messages on the signs:

non-BZ/WCS members
those who visit zoos more frequently
those who spend more time at the exhibit
those visiting without adult companions.

BR bulletin board:

non-members
less educated visitors
those visiting without adult companions.

BR question/answer lift panels:

individuals who visit zoos more frequently.

(In contrast to visitors accompanied by children, those visiting without children were more likely to report that they "did not look" at the lift panels.)

HH diary excerpts:

females
older visitors
those who visit zoos more frequently
those who spend more time at the exhibit
those visiting without children
those visiting with adult companions.

HH world map locating various conservation projects:

non-members
older visitors
less educated individuals
those who spend more time at the exhibit.

HH sign with quotation from Buddhist writings:

older visitors
those who spend more time at the exhibit
those visiting without children.

Hands-on exhibits.

GA/CT hands-on exhibits:

females

younger visitors

those who visit zoos less frequently

those visiting with children.

BR telescopes:

those visiting with children.

(Females visiting without children tended to rate the telescopes less appealing than did females with children or any males.)

BR ibex horns:

females

less educated visitors

those who spend more time at the exhibit.

HH radio tracking collar:

females

less educated visitors

members.

Sensory exhibits.

(That is, visually-oriented or aurally-oriented displays [e.g., those including photographs, silent videos, or informational audio recordings])

GA/CT sensory exhibits:

less educated visitors

those visiting without adult companions.

Visitor Behavior Observed at the Display

The following distinct behavior categories are presented along with the various visitor segments likely to engage in them.

Child-oriented behaviors at the BR
(from among visitors accompanied by children):

females

members

those visiting without adult companions.

Child-oriented behaviors at the HH
(from among visitors accompanied by children):

members

older individuals

those visiting without adult companions.

Adult-oriented behaviors at the BR
(from among visitors accompanied by adults):

those visiting without children

those who visit zoos less frequently.

Adult-oriented behaviors at the HH
(from among visitors accompanied by adults):

those visiting without children.

Self-oriented behaviors at the BR:

older individuals.

Self-oriented behaviors at the HH:

those visiting without children

those visiting without adult companions.

Watching other BR visitors manipulate an exhibit component:

males

those visiting with children.

Watching other HH visitors manipulate an exhibit component:

females

older individuals

those visiting with children

those visiting with adult companions.

Length of Time Spent at the Display

Baboon Reserve:

those visiting with children,

older individuals, and

more educated visitors tended to stay longer.

Himalayan Highlands:

females,

those who visit zoos more frequently, and

less educated visitors tended to stay longer.

Gender Differences

Among Visitors with Children

Of participants visiting with children,

Females, in contrast to males, rated the interests of the children in their group as more important in deciding which zoo exhibits to view;

Males were willing to pay a higher admission charge than females for the Congo Forest Conservation Trail exhibit.

Methodological Limitations
of the Present Study

One complication of this research resulted from the attempts of individuals to complete the learning style assessment instrument while accompanied by group members. The instruments require self-description, which, of course, should be an individual activity, but tends in some cases to be a very personal exercise as well. The privacy of some visitors appeared to be threatened by companions "looking over their shoulders." The consequences may not have been only discomfort, but possible inaccuracy as individuals endeavored to maintain their social facades rather than disclose their true selves.

Those companions who did not take an active interest in the completion of the survey (the majority of children are included in this group) sought to entertain themselves in the nearby exhibit vicinity. It was not uncommon, however, for patient waiting to evolve into impatient hovering. Even without this overt display of restless irritation, many participants seemed well aware of a "social group-induced" time limit beyond which companions (especially children) would not tolerate. Under such rushed circumstances, the quality, accuracy, and reliability of responses cannot go unquestioned.

Nonetheless, the fact that the learning style instruments formed the initial part of the follow-up survey (completed after viewing the exhibit) suggests that visitors indeed may have given them the requisite time and thought, as impatience would not have arisen yet.

Future research might make an effort to engage all group members in some type of activity, be it directly related to the study's objective or merely to keep everyone occupied and entertained. As visitors are giving of their leisure time, it is incumbent upon the researcher to attempt to make the participation experience a pleasant one.

CHAPTER IV:

DISCUSSION

Whereas the Results section was organized around the four different samples (GA, CT, BR, HH), the Discussion will focus on specific content areas. It will begin at the heart of this study, with learning styles. An exposition will be provided of why the application of learning styles to leisure learners was not unconditionally successful. Afterwards, issues relevant to leisure research, such as visitor group composition and gender differences, will be addressed. The Discussion section will conclude with suggestions for future research and recommendations for zoo exhibit design.

Insights Derived from the Application of Learning Style Theory to Leisure Learners

The distribution of findings regarding learning styles illustrates that there were, in fact, more hits than misses (see Summary of Results in previous section). However, the application of these two learning style theories to informal learners in a leisure setting did not meet with unconditional success. The following commentary offers insights into the possible causes of this outcome. The discourse will revolve around three themes: the context, the participants, and the theory.

The Context

The Zoo Environment

The stereotypical zoo is not primarily perceived by the general public as an educational institution, but rather as a recreational center. Hence, a trip to the zoo, as a leisure outing, tends to be a rather "mindless"[44] event. Under such circumstances, asking visitors to articulate what they learned at an exhibit and to earnestly consider how they prefer to learn (as did one of the learning style assessment instruments) may have seemed to them incongruous in a setting not known particularly for its educational qualities.

Zoo Exhibits

Each of the exhibit components evaluated in this study may not have exemplified the specific characteristics preferred by a particular learning style. That is to say, some of the displays combined preferred tactics from more than one style. For instance, the participatory lift panels at the BR exhibit involved text, a question/answer format, and a hands-on action. It is somewhat difficult to hypothesize

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[44]"Mindless" as defined by Moscardo and Pearce (1986, p. 93) is "a mental state where there is little questioning of new information and where individuals are mentally passive and are processing the environment according to pre-existing scripts and routines." Mindfulness, in contrast, "is characterised by detailed attention to a task or activity and analytic processing of material resulting in changes in cognitive structures."

which one learning style would most appreciate this conglomeration. Because "hybrid" exhibit components were used, the various learning styles might have found different redeeming qualities in each display, thus clouding the results. In the end, we do not know what it was about each exhibit that the different styles liked or disliked.

Social Setting

Because of the social group context, the learning styles of the other group members may be as important as the individual's own style. Having adult companions with different styles or being accompanied by a child may draw individuals (regardless of their styles) into experiences, observations, or activities which they would not have chosen on their own. As part of a group, the individual's style may, in fact, be superseded by the group's style, as an interactive whole.

McManus (1987) has suggested that the way in which visitors interact with an exhibit is influenced by their social context. Diamond (1986), moreover, concluded that learning primarily occurs, not as a result of the interaction between individual visitors and exhibits, but rather due to the social interactions between visitors. She explained that family members experience objects differently and communicate in different ways. Whereas children often transmit concrete information, parents tend to convey more symbolic material.

Hilke (1988, 1989) also found that although visitors pursued personal agendas to learn, they complemented these individual efforts with behaviors aimed at interacting with companions. Thus, the exploration and interpretation of an exhibit is often bounced back and forth among group members. Unlike traditional formal education, informal learning at a zoo is not a completely individualized effort.

Affordances of the Setting

As the concept of behavior settings would attest, the context, to some degree, is responsible for the behaviors which occur. In this case, the affordances of the environment tend to elicit particular learning style characteristics.

For instance, formal education traditionally caters to "abstract-type" learners. Within a classroom, two-dimensional instructional materials (e.g., words, symbols, and illustrations) predominate and linear learning is standard. Students are taught concepts and must practice applying them. In such an environment, abstract learning types (e.g., Assimilators, Abstract-Sequentials) can comfortably exercise their natural styles whereas the more concrete and right-mode learners (e.g., Accommodators, Concrete-Randoms) are forced to adapt to "unnatural" instructional methods in order to meet academic goals.

Leisure settings (e.g., zoos and museums), on the other hand, may cater to the learners at the opposite end of the spectrum. With three-dimensional subject matter, a less sequential instructional format, and unrestricted social interaction, the informal education environment may provide optimal opportunities for concrete and right-mode learners to demonstrate their natural styles. Under these leisure circumstances, the abstract-type learners may forego their dominant styles to engage in the hands-on, socially interactive, and experimenting behaviors more appropriate to the setting. Hence, a person's behavior may be just as dependent on the context as on his or her learning style.

The Participants

Age and Education

The human growth process, according to Kolb's Experiential Learning model, is divided into three broad developmental stages.

> The first stage, Acquisition, extends from birth to adolescence and marks the acquisition of basic learning abilities and cognitive structures. The second stage, Specialization, extends through formal education and/or career training and the early experiences of adulthood in work and personal life. In this stage, development primarily follows paths that accentuate a particular learning style....This stage, in our thinking, terminates at mid-career....The third state [sic], Integration, is marked by the reassertion and expression of the nondominant adaptive modes or learning styles. Means of adapting to the world that have been suppressed and lay fallow in favor of the development of the more highly rewarded dominant learning style now find expression in the form of new career interests, changes in life styles and/or innovation and creativity in one's chosen career.
>
> Through these three stages, development is marked by increasing complexity and relativism in dealing with the

> world and one's experiences, and by higher level integrations of the dialectic conflicts between the four primary adaptive modes: Concrete Experience, Reflective Observation, Abstract Conceptualization, and Active Experimentation. (Kolb, 1976, p.7)

The mean age category for three of the present study's four subsamples was "35-44" years old. The mean age of the participants at the Himalayan Highlands, in contrast, was "25-34." The mean level of education completed within each of the subsamples was "some college." From these two indicators, the overall sample appears to be composed primarily of individuals between the second stage, Specialization, and the third stage, Integration.

Hence, it is possible that, due to their "advanced" age and/or education, the respondents in this study are more well-rounded and eclectic in terms of learning styles such that the preferences and behaviors of the different styles are much less pronounced and definitive.

Reason for Zoo Visit

The motivation for visiting the zoo may also be a factor undermining the utilization of learning style theory in this leisure environment. Three prominent reasons for visiting appear to detract from potentially educational interaction with exhibits.

First, this sample of zoo visitors was collected during the summer ("peak") season. Among summer visitors are those for whom a zoo visit is merely an annual event (Wolf & Tymitz, 1981). They have come for no more reason than to maintain family tradition.

Next, there are cultural/ethnic groups who often tour in large clusters. They appear to approach a zoo visit as an alternative weekend pastime, not meant to be much more than a leisurely stroll through a park.

Lastly, there are those visitors who have made the trip "for the children" (Milan & Wourms, 1992; Rosenfeld, as cited in Serrell, 1988a). From this motive, the reasoning may follow that the goal is not particularly for the adults (who participated in this study) to gain from the experience.

Educational endeavors attempted by the zoo may be lost on visitors such as these, who are not open to an educational experience in this recreational setting. For such visitors, the topic of learning styles may have been completely foreign to their zoo excursion. (This is not to say, nonetheless, that these visitors stand no chance of being attracted by an exhibit and thus learning in the process.)

Mind Set

In a formal education environment, students recognize that a primary objective of the experience is increased understanding and personal growth. Such an expectation is not inherent to leisure activities. Few individuals state that the reason for their zoo visit is to learn (Milan & Wourms, 1992; White, 1983; Wolf & Tymitz, 1981). Rather, many arrive in an entertainment frame of mind. Driven by no particular learning goal, casual visitors (informal learners) may take a more passive, observing stance, in contrast to the active, thinking disposition of students in a formal classroom. For this very reason, zoos must attempt to convey information in an entertaining manner to "hook" visitors. For without education as a specific objective, visitors will not go out of their way to learn.

Given these circumstances, it may be a flawed assumption to think that individuals behave in a similar manner whether they are at "work" or at "play." In other words, the way in which a person prefers to learn in a formal setting may be irrelevant to a social leisure context. Moreover, individuals may truly describe themselves quite differently when in a leisure setting as opposed to a formal education environment. Hence, the present study's survey may have been tapping this recreational attitude. A person's "general" self-concept or "universal" learning style may not be viable constructs; one's context must be considered. Regardless, to request that visitors engage in earnest self-reflection while immersed in a leisure mind set may have created a conflict, the consequences of which were suffered by the survey results.

Expected Behaviors and Exhibit Preferences

Three factors contributed to confounding the results associated with expected behaviors and exhibit preferences.

First, the uneven distribution of both Kolb's styles/modes and Gregorc's styles resulted in small cell sizes. This made some analyses difficult, if not impossible, especially when samples were first disaggregated by gender. Second, the small range of observed manipulation occurrences might have prevented any relationship from appearing between behavior and styles among the participants.

Third, the exhibit components might have been held to different standards by people having the various styles. For instance, individuals with styles expected to prefer textual signs may actually prefer the act of reading as part of the learning process and, hence, hold the signs to a higher standard. Their rating of how appealing they found written messages would then appear similar to that of participants who simply do not appreciate text in general compared to more active forms of information intake. Consequently, the outward appearance of equivalent preference ratings would be masking very different meanings.

The Theory

Because both learning style typologies fared equally well (or poorly, depending on one's perspective) in this study, there is no reason to believe that they do not suffer from similar inadequacies when applied in a leisure environment.

Based on Formal Education

Learning style theory arose from the dilemmas faced in formal education environments. Teaching all students by one method had, time and again, proven unsuccessful. The realization came to the fore that individuals had different needs and each could be taught most effectively using very different instructional techniques.

Various attempts have been made to distinguish different types of learners. Two of these typologies were employed in this study: one based on Kolb's Experiential Learning Theory and the other on Gregorc's phenomenological approach. Each of these has been further developed into an instructional system (by McCarthy, 1987, and by Butler, 1987, respectively) so as to be practically applied in the classroom. As such, each style has been associated with instructional preferences.

The descriptions of the four different learners in each typology are not intended to be relevant only to formal education processes. For Kolb (1976, p.6) emphasizes that

> individual learning styles affect how people learn not only in the limited educational sense but also in the broader aspects of adaptation to life, such as decisionmaking [sic], problem-solving and lifestyle in general. Experiential learning is not a molecular educational concept, but rather a molar concept describing the central process of human adaptation to the social and physical environment.

Gregorc (1982, p.6) likewise explains, "The Style Delineator reveals the perception and ordering abilities used by us to transact in and adapt to our everyday environments whether it be at home, on the job, in the classroom, or in social interactions with other individuals."

Nonetheless, style characterizations appear more amenable to formal education procedures and strategies. Descriptions of the various learners, which at first appeared rather straightforward, became quite ambiguous during attempts at application. Forming hypotheses about exhibit preferences of the various styles was a less-than-precise undertaking due to both the indistinct exhibit components and the overly general learning style descriptors.

The case remains, however, that the learning style typologies employed in this study may simply be inappropriate to exhibit design. These styles may, in fact, go unexpressed when the individual is not driven toward academic goals. It is possible that individuals are more "laid-back" and open-minded to various forms of exploration and information intake when in a relaxed recreational atmosphere. They may feel less need to hold to their preferences so rigidly. If they are not striving to achieve anything specific (unlike in formal education), they may be less inclined to conform to doing things in the way most personally effective and efficient. In such cases, their learning style, as assessed by the Kolb or Gregorc instrument, would be meaningless in interpreting their behaviors or preferences at the zoo as they have, in effect, stepped out of their learner role to become a leisure visitor.

Individualistic

Learning style theories, as applied in formal education, are very individualistically oriented. That is, they delineate characteristics of individuals irrespective of the environment and any specified objective. No problem is presented, of course, when they are used to guide teaching practices, for the setting is the classroom and the goal is to learn, just as implied by the typologies. When used to address individuals outside of the classroom (e.g., at a zoo) who are participating in an experience with a less definite goal (e.g., to raise awareness), the context-specific nature of the typologies becomes apparent and restrictive. Three circumstances make these typologies less-than-malleable to the informal education context.

To begin, unlike in a formal education situation, during a recreational activity individual achievement need not be stressed. At the end of a leisure experience, visitors are not required to prove that they learned anything. As previously noted, without such obligation, it seems unreasonable to expect that individuals would necessarily display their learning style in an unmodified manner.

Furthermore, it is plausible that individuals not only fail to exhibit but, in fact, intentionally abandon their own style during leisure events. An individual (such as a parent) may forsake his/her own style in order to create an experience for a companion (especially a child). That is, the preferences of a child may take precedence over an adult's own desires. For instance, visitors accompanied by young children frequently commented that if they were alone they would read more of the exhibit graphics, but "with a two-year-old, that's not possible." In such cases, adults may defy their natural inclinations due to the fact that the goal is no longer self-improvement through cognitive gain, but the enlightenment and enjoyment of a child.

Lastly, the typologies employed in this study fail to take into account social interaction. Learning in museums and zoos, however, is in large part a group process (Diamond, 1986; Hilke, 1988, 1989; McManus, 1987). Companions engage one another with exhibits directly (e.g., operating a telescope together) and indirectly (e.g., paraphrasing a question label for companions who did not read it). Consequently, one's visit experience is a result of one's own interactions with exhibits as well as one's interactions with other group members. Under such social circumstances, how can an individual adhere to a personal learning style? Inherent to being embedded in a social context are one's connections to others. As an individual style cannot be maintained intact, the implication may be that these styles are not appropriate to a group effort. Rather, constellations of individual styles might be used to create composite "group styles," a construct more applicable to a socially interactive experience.

Underdeveloped Typologies

In order for learning style typologies to be useful to informal learning contexts, they may need to be extended. Three possible extensions are considered below.

First, each of the styles could be augmented by including preferred modes of learning informally in a manner parallel to the formal education preferences. This is assuming each of the styles has informal counterparts. In other words, all formal learners of one style become the same style of informal learners. This, however, seems unlikely.

Hence, a distinct typology for informal learners might be developed which is similar to that of formal education learners. Within such a classification, the emphasis may be more appropriately placed on a person's "social experiencing" manner, rather than merely on the "casual" methods used by individual learners to interface with information.

Or, a typology might be in order to describe groups, rather than individuals, as group learning styles may be more pertinent to a social informal learning environment.

Of course, the possibility exists that learner typologies in general are doomed to failure in a context of social and entertainment emphasis. Should then all attempts at applying learning style theory to informal learners be abandoned? The following discussion addresses whether such typologies are of any use to the leisure environment.

Significance of Learning Style Findings

The main purpose of the current study was straightforward: to apply the formal educational theory of learning styles to informal learners in a recreational setting. The immediate goal was to determine whether learning styles can be generalized to a leisure environment. Presupposing the success of the immediate goal, the intermediate objective was to inform exhibit design. Toward this end, the identification of a target group was undertaken. The ultimate purpose of this research sought to improve a recreational environment's potential to informally educate.

The Relevance of Learning Styles to Leisure Environments

What was the outcome of the immediate goal? That is, are learning styles a useful concept to apply to a leisure environment? Schroeder's (1991) study (unprecedented in this area) offered a resounding "Yes." He found that the learning styles of museum visitors (as assessed by the Myers-Briggs Type Indicator - MBTI) significantly influenced what they learned from exhibits. The current study, on the other hand, can provide no definitive conclusion, given the present state of learning style typologies.

The differences between the two studies are informative. Schroeder's research involved adult visitors (over the age of 18) to the Rain Forest exhibition hall of the Milwaukee Public

Museum. Approximately two-thirds of the visitors who were approached agreed to participate. Those with small children were not asked. Both cued and non-cued visitors were observed viewing the exhibit. The cued participants were warned that they would be tested on the exhibit information. Afterwards, respondents completed a demographic sheet, a questionnaire, and the MBTI (Form AV), which is a 50-item learning style assessment instrument. This process, on average, required 20 minutes. Upon finishing, visitors were thanked for their cooperation and participation.

According to their psychographic characteristics, zoo visitors, as a whole, may be quite distinct from museum visitors (Hood, 1983; Milan & Wourms, 1992). Regardless, four methodological differences, all interrelated, suffice to illustrate the contrast between Schroeder's study and the current one.

Unlike the museum study, the current zoo study included visitor groups with young children. As these groups form a prominent portion of the total zoo audience, their exclusion would severely limit the generality and usefulness of the findings.

In addition, no zoo respondents were forewarned that they would be "tested" on the exhibit information, only that they would be asked for their opinions. This was an attempt to elicit their natural exhibit viewing behaviors.

Furthermore, an incentive (in the form of a key chain) was offered as a reward and enticement for participation. On the one hand, this strategy may have contributed to a lowered refusal rate (17%-23%) compared to Schroeder's study (approximately 33%). On the other, it may have attracted a wider spectrum of the zoo audience, including those whose exhibit experiences appear to be much more hurried affairs.

The precise reasons for the lack of spare time among the current visitors cannot be known for certain, but hypotheses can be offered. It could be due to the fact that the majority of the zoo sample was composed of New Yorkers (known for their quick pace). It could be a function of the children in the group, who could not be kept entertained for long. It could relate to the fact that the Bronx Zoo/Wildlife Conservation Park is very large and many visitors hold to the intention of seeing every exhibit during the course of their one-day visit. Because of the park's vastness, moreover, the participant could not be left behind momentarily while the rest of the group proceeded. Or, the reason for their haste could simply be that leisure visitors at a zoo prefer not to be bothered.

Regardless of the cause, in light of how rushed the participants in the zoo study appeared, requesting 20 minutes of their time (as Schroeder did) is unthinkable. The brief encounter with one unsolicited visitor at the Conservation Trail is illustrative: "Do you accept monetary donations?" she asked as she walked by. "No, only opinions," the researcher responded. "Well!" she exasperatedly replied as she kept walking, "I have time to give money, but not my opinions."

The most significant consequence of these circumstances is that the MBTI, though it has demonstrated success in an informal learning environment, due to its length and time requirements, stands little chance of being utilized with casual zoo visitors. This is significant in that it is the assessment instrument which ultimately determines the success or failure of the application of learning style theory.

The answer, therefore, to the original question of whether learning styles is a concept useful to leisure environments depends. It depends on the specific learning style theory and instrument used. It depends on the participants included in the sample. And it depends on the specific goals sought by the application.

Conclusions from the Present Zoo Study

The current study employed both Kolb's and Gregorc's theories; included a sample representative of the total zoo audience; and sought to inform exhibit design practices. Though its success was somewhat limited, the following basic conclusions are worthy of note.

Gender Bias

This research served to expose a possible weakness of both learning style theories: They appear to be genderbiased. That is, gender differences were found among the typology distributions. For instance, within Kolb's theory, Concrete-Experiencers were more likely to be female; Abstract-Conceptualizers were more likely to be male. Among Gregorc's styles, Abstract-Randoms were more likely to be female than male. These findings suggest that the Kolb and Gregorc assessment instruments may measure more than learning style alone. By failing to be gender-neutral, it appears they may not clearly distinguish styles of learning from inherent gender characteristics.

<u>Disproportional Typologies</u>

Either within each gender or across the entire sample, it was also found that Kolb's style/mode typologies and Gregorc's typology were all quite unbalanced. That is to say, the four classifications (from any of these three models) are not equally represented among the zoo audience. For instance, there are relatively few Convergers (11% of the total LSI sample) and Concrete-Randoms (14% of the GSD sample), and many Assimilators (42%) and Concrete-Sequentials (41%).

Just as Kolb (1984) found distribution differences among educational specializations (e.g., undergraduate business majors tended to be Accommodators, whereas engineers were likely to be Convergers), the distributions from the present study may be distinctive of zoo visitors. If future research supports a link between learning styles and exhibit preferences, such a distribution could have implications for exhibit design. A simple 25% of exhibit interpretives per style may not be an appropriate strategy.

Target Groups

One intention of the present study was to distinguish a target group of visitors from among the total zoo population. This group of self-identified prospective Congo Forest patrons was to be characterized in contrast to the general audience. The results of this attempt were as follows.

The Congo Forest Conservation Trail (CT) group was distinguished by the fact that it consisted of a larger proportion of BZ/WCS members and, hence, the individuals in this group tended to visit zoos more frequently. Members may have been attracted to the Conservation Trail because they tend to be familiar with all parts of the zoo and, thus, may have wanted to investigate this "new" feature. Furthermore, in contrast to the General Audience (GA) subsample, more groups at the Conservation Trail consisted of adults without children. Despite these differences in background characteristics, no differences in learning style distributions surfaced.

The following insights can be drawn from this endeavor. The hope of distinguishing a target group may have been dashed from the outset due to the specific exhibit involved. That is, Congo Forest is to be a spectacular new exhibit, the centerpiece of which are the gorillas. According to observations of visitor viewing patterns, gorillas appear to be one of the most popular zoo animals, due in part to their "humanoid" features (Robinson, 1987) and human-like antics. As a result, one would be hard-pressed to find a segment of visitors uninterested in such an exhibit. In this case, the target group, in effect, defaulted to the total audience. Thus, few differences appeared.

A better test of this strategy would have been to distinguish a target group for a more specialized interest. The BZ/WCS's proposed Bird Conservation Hub, a facility dedicated to research on endangered bird species, may have sufficed, as bird enthusiasts tend to form a distinctive group (Kellert, 1980).

The Process of Learning

Yet another finding worthy of consideration involves the concept of learning. At the BR exhibit, one of Kolb's mode categories, Active-Experimenters, explained that they did not learn because they did not read. Their explanation implies an assumption that learning depends on reading. Yet for this particular style of learner, reading is not the preferred intake mode. These individuals should not be destined to learn nothing simply because they do not choose to engage in reading.

The goal should be to dispel the notion that learning be attributed solely to written material. Learning style theory, by its very nature of recognizing individual needs and preferences, strives in this direction. Zoos (and museums) must continue to reinforce this understanding by furthering their efforts to create exhibits which convey information by means other than text. This endeavor, undoubtedly, will require visitor studies aimed at gaining a better grasp of how people relate to a wider variety of display formats.

Hands-on Components

The factor analysis of exhibit components at the Baboon Reserve resulted in two factors, one being a hands-on composite. The two constituent displays of this factor (i.e., the telescopes and the touchable ibex horns) were inversely related. In other words, visitors who found the telescopes more appealing also considered the horns to be less appealing, and vice versa.

Along similar lines, the ibex horns and the radio collar were both stationary three-dimensional display components. Despite the similarity of their outward appearance, however, their respective functions, meanings, and values for visitors appeared to differ tremendously. Compared to Kolb's other three styles, Convergers rated the radio collar less appealing and performed more behaviors associated with the ibex horns.

It may be that the horns hold more appeal due to the fact that a question lift panel is associated with them.

Consequently, touching them (and counting the growth rings) may be a means to an end, as visitors attempt to answer and further understand the lift panel's text. For the radio collar, conversely, touching may be an end in and of itself. Or, it may be that animal "parts" (e.g., horns) simply hold more attracting power than do "inanimate" objects (e.g., the collar). Regardless, these apparent conflicts suggest that hands-on displays should not be overgeneralized; each "manipulable" may have quite distinct qualities.

Individuals Embedded in Social Groups

Lastly, studies such as this are often undertaken to account for differences among visitors. The origins of visitor studies divulge a marketing research slant, as audiences were disaggregated primarily by demographic traits. Going one step further, researchers such as Hood (1983, 1984) pronounced the importance of recognizing visitors' psychographic characteristics (i.e., "their values, attitudes, perceptions, interests, expectations, satisfactions" (1983, p. 51)). Cognitive/personality variables such as learning style are another step along this same path. The dilemma faced by this route of inquiry is the social dimension. All of the individual qualities uncovered must be reinstated and examined within a social context which is infinitely more complex than the theoretical vacuum from which the attributes of interest initially arose.

Visitor researchers focusing on group dynamics, such as Diamond (1986), Hilke (1988, 1989), and McManus (1987), eluded this predicament by establishing their investigations upon the recognition of the social structure of visitor behavior. The significance of social embeddedness to an understanding of visitors is at once blatant and disconcerting. Acknowledging the complexities of the social web results in research which is as much more realistic as it is more confounded. Nonetheless, as simplistic inquiries can result in no more than half-truths, reality demands that the whole picture be kept in view such that research produces findings of greater accuracy and applicability.

Findings Significant to Leisure Research

Although the thrust of this research related to learning style theory, a study of this magnitude cannot fail to secure information about visitors which may be relevant to leisure researchers and marketing efforts.

Audience Composition

This zoological park audience appears to be composed of slightly more females (60%) than males (40%). It is possible that these percentages are, in part, a remnant of the fact that males may be more apt to refuse to participate. However, a similar 60/40 gender split reported by MarketVision

Research, Inc. in their 1993 Bronx Zoo/Wildlife Conservation Park visitor attitude survey and a 57/43 female/male proportion found by Clark, Martire, and Bartolomeo, Inc. in their 1990 study of Bronx Zoo visitors suggest that this is an accurate estimate consistent with previous findings.

A similar percentage difference exists within this zoo audience between those visitors accompanied by children and those in strictly adult groups. Across all four of the subsamples, 58% of the participants were visiting with children. However, because the Conservation Trail group was self-selected and the decision to approach was made with the knowledge that there would be an admission charge per head, visitors with very young children or those with many children may be underrepresented. Hence, excluding the CT group, 61% of the respondents in this study were visiting with children.

Either way, this conclusion replicates the Clark, Martire and Bartolomeo 1990 study which found that 60% of Bronx Zoo visitors had children in their group and the 1993 MarketVision Research survey which reported that 62% of respondents were accompanied by children. In actuality, all of these reported percentages may be under-estimates, as visitors with young children are prone to decline participation in surveys.

Of course, a methodology better suited to more accurately determining the zoo audience composition would be direct observation, such as counts of visitors as they pass through the entrance gates.

Audience Segmentation

The analyses of behaviors observed at the Baboon Reserve and Himalayan Highlands exhibits demonstrated the existence of three distinct audience segments. One group tended to focus on interactions with a child. Females, BZ/WCS members, older individuals, and those visiting without adult companions were more likely to be in this category. A second portion of the audience, likely to be individuals visiting without children, tended to interact with other adults. The third segment was composed of individuals who, on their own, interacted directly with displays. Older individuals, those visiting without children, and those visiting without adult companions tended to be in this group.

For the most part, these three sets of behaviors were highly independent of one another. At the Baboon Reserve, however, child-oriented and adult-oriented behaviors were inversely related, to a small degree. In other words, visitors who interacted more with children tended to interact less with adult companions, and vice versa.

This segmentation suggests that individuals engage, more or less, in a finite number of interactions. As the number of members in a visitor group increases, it cannot be assumed that the number of interactions among these individuals also increases. The total number of interactions, though dispersed differently amongst the dyads, may remain approximately the same. For example, individuals visiting with a child were more likely to interact with the child if they were not accompanied by another adult. Likewise, individuals visiting with another adult were more likely to interact with the adult if they were not accompanied by a child.

This finding seems to indicate that the majority of social interactions occur in dyads. Because zoo visitors, as a group, may highly value social interaction (Hood, 1983), the zoo might try to design displays which enhance social behavior between two individuals.

On the other hand, there is also that third segment of the zoo audience who experience exhibits without engaging in social interactions. These visitors also must be addressed. Bitgood (1994, p. 10) suggests, "In some situations, it might be appropriate to design an exhibit so that it provides different types of experienes [sic] for groups who wish to socially interact as well as for individuals who wish to experience an exhibit in a solitary manner."

Visitor Behavior

Social Interactions

In comparison with the Baboon Reserve exhibit, at the Himalayan Highlands display, the frequencies of observed social behaviors (e.g., talking, showing) were all quite low.

One possible explanation for a lack of observed behaviors relates to the methodology employed. Although visitors were not specifically told that their actions would be recorded, the researcher stood unobtrusively nearby with a clipboard. Whenever "cued" visitors are involved, there is the risk that their behavior will be less than natural. In the case at the Himalayan Highlands, some visitors might have felt inhibited because they knew they were being watched. However, the same procedure was used at the Baboon Reserve, yet the behaviors were performed much more frequently.

At the BR exhibit, it is possible that the researcher was less apparent or that the visitors were more engrossed. Still, the more likely (and obvious) reason for the lack of social interactions observed at the HH display is that a larger portion of participants were visiting this exhibit alone.[45]

Physical Interactions with the Exhibit

In contrast to social interactions, the frequency of manipulation behaviors observed at the Himalayan Highlands was only slightly less than that observed at the Baboon Reserve. Given the features of the HH exhibit, this finding is not surprising. To begin, the HH display modules were more visually and textually oriented. They simply did not offer a great degree of participatory opportunities. Moreover, the primary hands-on activity that they did present (i.e.,

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[45]Recall that the HH display is located down four stairs. Because it is not accessible to strollers, companions often could not accompany the participant. In addition, the HH display had no live animal component, so other group members tended to be disinterested.

rotating panels) was not apparent to all visitors. That is, some participants, not aware that the panels were meant to be flipped, did not touch them.

Still, the percentage of visitors who manipulated some participatory component at either the BR exhibit (73%) or at the HH display (67%) mimics previous visitor findings. Derwin and Piper (1988) reported data accumulated from tracking 70 non-cued visitors, 12 of whom were children, in the African Rock Kopje exhibit at the San Diego Zoo. They found that 79% of these visitors "touched or used at least one element during their stay in the kopje" (p. 443). McManus (1987), likewise, unobtrusively recorded behavioral observations of visitor groups at the British Museum (Natural History). She found that 78% of the groups "played" (i.e., "any group member" touched or manipulated) at interactive exhibits.

At first, the percentage of visitors reported by either Derwin and Piper or McManus appears to be slightly greater than that observed at the BR or HH displays. However, the kopje study encompassed a larger display area and a greater number and variety of components. In addition, both the kopje sample and McManus's observed groups included children and children are more likely to touch, interact, and explore (Derwin & Piper, 1988; Diamond, 1986; McManus, 1987; Rosenfeld, 1979). Therefore, the frequency of manipulation behaviors at the BR and HH displays seems consistent with prior zoo, and museum, visitor findings.

This consistency is significant in that it further negates a plausible weakness in the present study's methodology. That is to say, if cued[46] visitors at the BR and HH displays interacted with the exhibits to a degree resembling that of non-cued visitors, the implication may be that cuing does not necessarily disrupt the natural behavior of visitors.

Gender Differences

In comparison to males, GA/CT females rated participatory lift questions and exhibits with touchable items more appealing. The BR females rated the ibex horn replicas more appealing. And the HH females rated the tracking device (i.e., radio collar) and the diary excerpts as more appealing than did males.

The fact that there were no exhibit types or components rated more appealing by males than by females may suggest that (1) the rating scale had a qualitatively different meaning for each of the genders, (2) women gave higher ratings to be "polite," or (3) women are simply easier to please. However, because one group of females rated the verbal description of exhibits with touchable items as more appealing than did males and two independent groups of females rated actual touchable exhibit components more appealing (the ibex horns at the

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[46]Cuing in the present study refers to the fact that participants knew they would be asked for their opinions about the exhibit.

Baboon Reserve and the radio collar at the Himalayan Highlands) suggests something more. The style distribution resulting from Kolb's typology demonstrated that females tend to prefer learning by concrete experience, males by abstract conceptualization. Hence, the concrete touchable objects at the exhibits may have truly held greater appeal for women.

Given an open-ended survey format, participants were asked, "Which part of the display did you like best?" Compared to males, females were more likely to volunteer that the signs were the best part of the Baboon Reserve exhibit and the diary excerpts were the best part of the Himalayan Highlands. At the Baboon Reserve, men were more likely to comment that the design of the exhibit was the best part. This hints at a possible gender difference in the way in which exhibits are experienced. Females may be more attentive to the individual display components, whereas males may be attuned to the physical construction dimensions of the total viewing area as it interfaces with the animal on display.

The Bronx Zoo/Wildlife Conservation Park is very large (265 acres to be exact). Because touring the entire zoo is impossible for most (although many start out with that goal), visitors must make decisions as to which exhibits to view. There are directional signs located along the paths and many visitors keep a zoo map in hand. Nonetheless, the interests of the children in the group was the factor ranked of highest importance in deciding what exhibits to see. Females, moreover, rated the children's interests as more important than did males. As the zoo designs new exhibits, especially ones with admission charges, it must realize that the advertising must appeal to children as well as adults, for it may be the children who, to some extent, call the shots.

Adult Visitors Accompanied by Children

At the Baboon Reserve, respondents visiting with children tended to stay at the exhibit longer than did those without children (as McManus, 1987, had found), in part due to watching the live animals and, in some cases, to experimenting with the telescopes. This relationship did not exist at the HH exhibit, however, presumably because there were no live animals. The reverse relationship, in fact, was not uncommon. As children could find little to interest them, other than the large stones separating the display tables, they acted as prompts to leave rather than stay.

At the Himalayan Highlands exhibit only 2% of the participants were observed reading text to their companions. This finding echoes that of Derwin and Piper (1988), who, during visitor tracking, failed to observe adults reading the panel information to the children accompanying them. Brennan (1977) recorded the same: "Only an extremely small percentage of the observed groups read the sign[s] out loud to each other" (p. 112). The text panels at the Baboon Reserve fared no better. The BR participatory lift panels, however, showed modest improvement, having been read by 7% of the observed visitors. These findings suggest three issues.

First, the brief questions on the lift panels may have induced conversation among group members. Provoking another person's curiosity and drawing him/her into thought appears to be a more effective way of attracting that person's attention, as opposed to reading the same information in the form of a statement. In fact, Wolf and Tymitz (1981) reported that questioning is the second most common form of conversation in the zoo and labels including questions appeared most interesting to visitors. They observed individuals reading labels with questions, who would then return to nearby companions and pose the same questions to their group.

Second, because active participation was involved, attention was not only initially attracted by the question, but it was held momentarily for the answer.

Third, in writing exhibit text, designers must be aware that, for the most part, only individuals at or above the reading level of the text stand a chance at receiving that information. If a message is also intended to reach younger visitors, the text must be simplified and made more attractive, hands-on components must be added, or some other creative technique must be employed. Though adults may paraphrase new-found knowledge (often adding their own misperceptions) for their companions in conversation, they cannot be relied upon to disseminate all of the messages to the children. Ways must be sought for the most important messages to reach the younger audience directly.

Visitors accompanied by young children often reported that they were unable to read as much of the exhibit graphics as they would have liked. Further, what they did manage to read may not have been very well absorbed. As one visitor explained, "Having a young child...with me is very distracting so that even though I read the displays I don't focus very well on the information."

Nonetheless, visiting an exhibit with a child can both broaden and deepen the experience for an adult. Children often direct the attention of adults to elements which would otherwise go undetected. For instance, at the Baboon Reserve, participants without children were more likely to report that they did not even look at the participatory lift panels.

Moreover, the curiosity and energy exuded by children compels adults into greater involvement, be it to answer a question or assist in the youngster's exploration. At the Baboon Reserve exhibit, those respondents accompanied by a child rated the telescopes as more appealing than did those without children. Without the child's impetus such exhibit components may not be as highly appreciated by adults, if even noticed.

Recommendations for Future Research

Zoo visitors may, in fact, be quite distinct from museum visitors. Not only is the physical context of their visit different, but their psychographic characteristics appear to vary as well (Hood, 1983; Milan & Wourms, 1992). Zoo visitors, not known especially for their educational motives, may form a class of more "casual" and social informal learners. Not to mention that most zoo exhibits have a live animal component, which must be maintained as the preeminent focus. So, although learning style applications may proceed in museums, it would be wise for a parallel line of research to develop in zoos. The following suggestions are intended to facilitate such efforts.

The Learning Style Assessment Instrument

In order to classify visitors according to learning style, a choice must be made as to which of the various assessment instruments to employ. As few of these have been tested on informal learners, there is little evidence of success or failure to guide this decision. Results of the present study, however, suggest that, for casual zoo visitors, an instrument of limited administration length is advisable.

Given that Schroeder (1991) found a dichotomous categorization of the Myers-Briggs Type Indicator (MBTI) to be related to museum exhibit characteristics and knowledge acquisition, the MBTI appears promising. On the other hand, the length of the shortest form (AV) of this instrument (i.e., 50 items) seems formidable. However, Schroeder explains that, of the MBTI's four indices, the Sensation-Intuition (S-N) scale is the "critical index" in determining learning style. Because "the preference on each index is independent of preferences for the other three indices" (Myers & McCaulley, 1985, p. 2), it might be possible to create a measure using only the items from the S-N scale. Such an abbreviated version could be more quickly completed by visitors.

Or, if the resultant dichotomy of styles is found to be too simplistic, two more-sophisticated models have also been proposed (Keirsey, 1979; Myers, 1962, 1974; as cited in Schroeder, 1991). Each of these combines the S-N scale with one other MBTI scale, resulting in a four-style typology. In this case, administering two scales rather than the full MBTI instrument would still be less time consuming.

Sampling Procedure

Irrespective of the assessment instrument used, it may be important initially to ensure that the sample is composed of "conscientious" participants. Including only adult individuals or adult groups may improve chances of success by eliminating the distractions that adults with children face.

It seems likely, moreover, that parents do not always answer according to their own preferences, but rather in terms of their children's inclinations or their desires for their children. For instance, one visitor at the Baboon Reserve did not get an opportunity to look through the telescopes, because it was crowded and she wanted the children to get a chance. Still, she rated them "very appealing" because she "imagined it would be good." Of course, this pattern of responding may be related to the parent's learning style, as individuals with certain styles were found to interact to a greater degree with children. Regardless, for the initial research efforts, excluding such potential "confounding" factors might be a wise strategy.

Hood (1989), in fact, found in a community survey on how adults make leisure choices that "the group most interested in leisure time learning was adults without children" (p. 155). Therefore, beginning solely with this group appears to be a reasonable step. As only one segment of the total audience, however, results could not be generalized. Further research, nonetheless, could then be guided by the success or failure of learning style theory with such distinct populations.

Mock-ups

Associating learning styles with exhibit types could be greatly simplified by intentionally designing the exhibits rather than using those which already exist. Exhibit mock-ups could be specifically developed (according to the formal education instructional preferences) such that each exemplified and emphasized the features preferred by one particular learning style. The confounding effects of "hybrid" exhibit types, such as those evaluated in the present study, could thus be avoided.

Reasons for Preferences

Subsequent research could make an important contribution to the learning style line of inquiry by endeavoring to procure the reasons behind preferences. In other words, it is not enough only to know which exhibit types are liked or disliked by individuals. It would be more informative to know "why": that is, what are the specific facets of an exhibit that different visitors find appealing. Through such an effort subtle preference distinctions may arise and a deeper understanding could then be established. Kolb and Fry (1975) provide the following illustration:

> We have found that although both Divergers and Assimilators prefer lectures, it is probably for different reasons. Both are comfortable in more passive, reflective situations but Divergers seem to be reacting most to the lecturer as a person (they also prefer faculty conferences, talks by experts and faculty feedback on papers) while the Assimilators seem to be reacting to the presence of an authority figure _per se_ (they also prefer assigned readings, exams and being given a task)....It is not enough to know that a lecture or lecturer was helpful or not. We need to know why. Only then can we begin to understand the person-environment interface. (p. 53)

Focus Groups

A research approach which might offer greater insight is the focus group method. A series of focus groups could be conducted, each with participants representing a particular learning style. For instance, a random sample would first complete a learning style assessment instrument. After their learning styles had been determined, a focus group would be held for each style separately. It could be enlightening to hear the issues raised by Accommodators as opposed to those discussed by Assimilators. In such a forum the topics of consideration can be as diverse as learning in zoos versus learning in museums, learning in general, expectations of a leisure experience, the ideal zoo visit, favorite exhibits, etc. The list is endless because focus groups often function by relating the main point through circuitous means. Open discussion of this form would appear to be a proper starting point.

Style Distributions of Leisure Pursuits

Kolb (1984) found his learning styles to be related to educational specialization in college. For example, undergraduate business majors tended to be Accommodators; history, English, political science, and psychology majors were likely to be Divergers; and engineers tended to be Convergers.

In similar fashion, Allen (1982) found that certain personality types were related to general areas of leisure interest. For instance, one personality type, represented by well-educated, confident, and self-motivated individuals, sought social, cultural, and intellectual stimulation in leisure. A second type, on the other hand, composed of relatively self-assured, independent individuals who enjoy their solitude, sought more practical leisure activities (such as auto repairs) rather than social or aesthetic experiences.

Hence, a zoo visit, as a leisure activity and an informal education opportunity, may be more attractive to certain personality types and particular learning styles. Just as educational specialization and professional careers (Kolb, 1984) may demonstrate distinct style distributions, leisure pursuits may as well. The distribution of styles among zoo visitors in the present study might be compared/contrasted with the style distribution among visitors at science or art museums, historical sites, or theme parks.

The Context-contingent Nature of Self-description

It is possible that individuals describe themselves quite differently depending on their immediate context. In other words, one's self-characterization when in a formal setting may not be the same as one's self-portrayal when in a leisure environment. This may, in part, be due to the inherent affordances (or demands) of a setting which allow (or require) particular aspects of one's personality to come to the fore.

Given the nature of self-description, holding the individuals constant while changing their context may provide clues as to how formal learning styles relate to informal styles. Toward this end, a repeated measures study might be conducted which asked students to complete a learning style assessment instrument, one time in a formal classroom and again while in a recreational setting. From such research the volatility of these style classifications could also be gauged.

Learning Styles of Exhibit Creators

From a different perspective, it might be interesting, if not illuminating, to compare and contrast the learning styles of exhibit creators (e.g., curators and designers) with the style distributions of the visitors. In formal education it has been found that mismatches between teaching and learning styles can undermine students' attitudes, comfort, and achievement. Jenkins (1988) elucidates this phenomenon:

> If the learning environment does not offer appropriate alternatives..., then students are forced to make the best of a less than efficacious situation. The energy they use to make adjustments may subtract from the energy available for learning. (p. 41)

As it seems unlikely that leisure learners would be motivated to expend extra energy, it might be informative to know the style base from which exhibit designers work. For just as teachers tend to teach the way they prefer to learn (Cornett, 1983), designers may tend to design exhibits according to how they prefer to experience them. A designer's style could then be further examined in association with his/her disposition for particular display techniques and components.

Juxtaposition of Theories

One final inquiry seems worthy of attention: that is, a comparison of Kolb's Learning Style Inventory with the Gregorc Style Delineator. The two theories, which each result in a quaternary learning style typology, hold one dimension (represented pictorially by a bipolar axis) in common: perception (i.e., the grasping of information). This axis, in both theories, is a continuum running from concrete to abstract. Kolb's second dimension (i.e., the axis perpendicular to perception) is transformation (i.e., the processing of information). This axis has as its endpoints active experimentation and reflective observation. In contrast, Gregorc's second dimension is "ordering" (i.e., the ways information is arranged, systematized, referenced, and expressed). This continuum runs from sequential to random. Hence, it might be informative to understand whether there is a relationship between these two instruments. For instance, would individuals classified as Kolb's Accommodators tend to be categorized as Gregorc's Concrete-Randoms?

Consideration of the Whole Visitor Group as well as the Designated Participant

As the present study demonstrated, it could be immensely beneficial to provide some type of activity for all group members, not solely the participant. One cannot always rely on the surrounding exhibits to entertain a respondent's companions. The notoriously short attention span of visitors requires that a specific effort be made to keep them occupied.

This was done, in fact, at the Conservation Trail, where all group members were told about the new Congo Forest exhibit, shown the designers' sketches and layouts, and given an opportunity to respond to very brief opinion surveys (such as naming the new gorilla exhibit) while the participant completed the more extensive form.

The purpose for this methodological strategy is twofold. First, it may prevent the participant from rushing through the study (i.e., survey, interview, tracking episode, etc.) merely to quell the impatience of companions. Second, the goal of a researcher, especially in leisure settings, should be to devise a participation exercise which is perceived, not as an inconvenience, but as a pleasant, worthwhile experience for everyone.

A Visitor's Perspective of Visitor Surveys

It is important to note that casual visitors who are asked to participate in a study have the freedom to decline if they find such a request to be an inconvenience. It was the experience of the present study that those who agree often value the opportunity to voice their opinions. Moreover, they appreciate the zoo's overt demonstration of concern for the visitors' views. Several interested visitors, especially the few who were familiar with learning styles, engaged the researcher in discussion as to the purposes behind the survey. They were impressed that the zoo, not a particularly educational institution in their minds, was attempting to employ this theory to benefit visitors' experiences.

Recommendations for Zoo Exhibit Design

This report cannot be closed without a word to the designers of zoological park exhibits. Spending hours observing individual displays affords a unique perspective on how successfully they are functioning with users.

Naturalistic Exhibits

The trend in exhibit design is toward creating naturalistic environments into which the visitors can be immersed. The goal is to construct a total experience which will engulf the visitors, thereby heightening their awareness by touching their emotions. The intention is to further understanding, as well as entertainment, by advancing a realistic perspective.

How successful have such efforts been? It all depends, of course, on who is asked. One young girl at the Baboon Reserve was overheard inquiring, "Is this the real Africa or are they just pretending?" Such a comment could be interpreted to suggest that the degree of simulation is astounding.

There are some, however, who might not find this naturalistic movement reason to applaud. Remarks such as the following evidence the existence of a disgruntled disposition among some visitors: "We've been here 20 minutes and I haven't seen a soul yet!" "What a waste of money and time; we haven't seen one animal all day." "I liked it better when they kept the animals in cages."

To combat the manifestation of an attitude completely contrary to the intended result, the following suggestions are offered.

Signs could be added to the exhibits explaining how to look for (and find) the animals. For instance, a sign could describe what to look for and, if possible, suggest the most likely places to see it (i.e., indicate where the animal spends much of its time). Signs could also be used to announce how many animals are in an enclosure. If nothing more, a sign could at least assure visitors that some animate object is there and they are not wasting their time looking.

Numerous visitors pass the northernmost Himalayan Highlands viewing point without seeing the snow leopard. Zoo volunteers leading groups were even observed overlooking the animal. Believing that it is empty enclosures into which they stare, simply encourages the development of negative attitudes, which visitors do not hesitate to embellish every chance they get. Moreover, the humiliation experienced by visitors who believe they have been searching for nothing is an emotion zoos could do better than instigate. The circumstances of this exhibit, conversely, could be made into a game of finding the "hidden" animal or utilized as an educational opportunity. Snow leopards in the wild rely on camouflage for their survival. Is it not amazing how well it works!

Safety also should not be neglected as a fundamental concern in the development of simulation exhibits. Natural paths undoubtedly have bumps, craters, and stones. These same features intentionally included in the "natural" paths of immersion exhibits, however, are not particularly safe for children. Numerous children were observed to trip, stumble, and fall on these naturalistic elements purposely lodged in the walkway. Given that children have plenty of accidents even on smooth surfaces, it seems somewhat unfair to engross them in sensory stimulation above their heads as well as beneath their feet.

It may, in fact, be possible to take naturalism one step too far. Those designers who would beg to differ might like to address the young boy in the Himalayan Highlands who, after being told the animals were snow leopards, asked, "Why isn't there any snow?"

Expectations for the Exhibit

Another characteristic of naturalistic exhibits that is extolled by some designers is the meandering path approach, which allows for unanticipated encounters. The secluded path without direct vistas or obvious endpoints contributes to the realism and the suspense of the journey. Nonetheless, visitors apparently are not always so eager to embark on such an adventure.

For instance, visitors would stop in at the northernmost Himalayan Highlands viewing point. Often after seeing no animal they would return to the main path rather than venturing further. Adults with strollers were observed to wait at the entrance or turn around after glimpsing the wooden bridge and the stairs. Perhaps the number of uncertainties discouraged them from attempting the trek. The following ameliorations might be considered.

Certain expectations of the experience could be provided at the outset. A sign with arrows, for example, indicating that other viewing points exist where the animals are usually more visible might prevent visitors from returning to the main path after seeing nothing. Another sign might reassure that there are no stairs to traverse, so strollers and wheelchairs are welcome. Lastly, a sign explaining that this "side trip" is not a dead end and will ultimately connect again with the main path might be in order to keep people from backtracking through the exhibit.

Too many signs, assuredly, spoil the naturalism. However, the graphics suggested here need not entail much text; symbols might suffice. Further, they would only denigrate the entrance, before the immersion experience began.

Before leaving this point, the issue of access must be emphasized. Strollers and wheelchairs should not be taken lightly, especially given the large proportion of visitors with small children. Paths through which a "double" stroller (e.g., for twins) cannot fit and displays located at the bottom or top of stairs seem unnecessary. Countless visitors bypass the Himalayan Highlands snow leopard conservation display, located at the base of four stairs, one reason of which is the fact that their child happens to be in a stroller.

Length of Stay

Three obvious factors relate to the length of time a visitor is willing to spend at an exhibit. First is the appearance of live animals. One of the main reasons visitors have come to the zoo is to see the "real" thing. They do not wait long; if there are no animals visible, visitors are hastily on their way to the next exhibit. This phenomenon was frequently observed at the Baboon Reserve. At times when the animals seemed to have disappeared, the visitors were always quick to follow. But when the animals were lingering in full view, quite a crowd could accumulate. The Himalayan Highlands exhibit was not vulnerable to such fluctuations. Having no live animal component (aside from the birds, bunnies, frogs, and squirrels) fostered visitor disinterest from the start such that the display was often avoided altogether.

The second factor, of immense importance, is visitor comfort. At the Bronx Zoo/Wildlife Conservation Park, "peak" season is coincident with the summer months. The hot weather, unfortunately, is not always conducive to pleasant viewing. A common occurrence at the Baboon Reserve was for visitors to leave the viewing enclosure prematurely due to inordinate heat. There is little use to developing inventive displays if they will be housed in an environment found insufferable by visitors. One cannot help but ask, "Can this enclosure in any way be ventilated?"

The initial two factors presented relate directly to the third. It is well known that animals tend to be most active early in the morning or late in the afternoon. Zoo visitors, on the other hand, are most populous at midday. During a New York summer afternoon, is it any wonder that the animals are silently, motionlessly resting and the visitors are uncomfortable? The National Zoo has posted signs recommending the best times of day for a visit. The Bronx Zoo/Wildlife Conservation Park might consider the same. This explanation and forewarning may mitigate the negative attitudes among visitors who cannot seem to find any animals.

Text Panels

The initial method of communicating with zoo visitors was through the use of textual signs. Messages, which originated as simple identification labels, have developed over the years into more colorful text. Still, visitors look to the text panels to identify the animals on display.

At the Baboon Reserve, however, the animal names are not a part of the panel titles. For instance, one panel is entitled "A HERD OF BACHELORS," referring to the fact that Nubian ibex tend to associate in single sex herds. Though such explanatory information follows, the practice of not including the animal's name in a prominent position seems questionable. It results in such misinterpretations as the following: "Look at those animals," a visitor announced while pointing at the ibex, "they're called bachelors."

Participatory Components

Not only has the text of exhibits been modified, but other forms of communication have been added as well. Participatory devices often attempt to convey messages in a more active hands-on manner. It cannot be assumed, however, that visitors inherently will understand how these devices function. The rotating panels at the Himalayan Highlands exhibit, for example, do not indicate their ability to flip. Hence, visitors frequently did not touch them. The question/answer panels at the Baboon Reserve exhibit originally designated "Lift," but the word has since worn off. Again, visitors were left wondering why they were being asked questions to which they could find no answers.

One of the Baboon Reserve lift panels was intermittently missing, which exposed the bottom part with the answer. This may have, in fact, inadvertently demonstrated the idea of "lifting" to uninitiated visitors. A more effective means of expressing this, nonetheless, would be to clearly print the instructions (e.g., "Turn," "Push," "Flip," "Lift") and make sure these words are maintained. If a creative display has been designed to be used in a particular manner, it is senseless to allow the experience to be lost to the guesswork of the visitor.

Concluding Remarks

Even though neither Kolb's nor Gregorc's learning style typology was established as the panacea for developing exhibit design guidelines, the present study has shed light on numerous factors which must be considered when approaching research which involves both leisure and education.

Results indicate that the formal education theory of learning styles, in its unmodified form, cannot be so easily transferred to leisure settings. Although these theories expound the inherent nature of one's personal learning style and thus suggest its consistency across life's various facets, a fundamental tenet of environmental psychology would argue otherwise. Individuals cannot be so readily disengaged from their context; in the end, behavior is interrelated with the setting.

The environment, in fact, may serve to elicit particular style characteristics. The formal classroom, with its focus on linear learning, two-dimensional materials (i.e., words, symbols, illustrations), and individual achievement may allow the abstract learning types (e.g., Assimilators, Abstract-Sequentials) to flourish while the more right-mode learners (e.g., Accommodators, Concrete-Randoms) are forced to adapt themselves to "unnatural" learning procedures. In contrast, leisure settings (e.g., zoos, science centers, museums), by nature, tend to offer three-dimensional subject matter, a less orderly information intake regimen, greater opportunity for socializing, and a more open-ended objective for individuals. The leisure context, hence, may allow the concrete and right-mode learners to exhibit their natural styles, whereas the abstract learners may exercise their nondominant abilities by engaging in hands-on, experimenting, or socially interactive behavior.

The explanation may lie in the fact that all learning abilities reside within each person's behavioral repertoire.

The context, it seems, plays a significant role in determining which behaviors are reinforced and displayed. Of course, the behaviors afforded by a setting will come more or less naturally for each individual.

Finally, learning style may have its basis in personality; however, it should not be equated with personality. Therefore, just because people do not behave exactly the same in leisure environments as they do in classrooms does not negate the existence of innate learning styles. It simply emphasizes the fact that informal education in recreational settings does not emulate formal education. Informal learning during a leisure experience is a unique phenomenon worthy of being understood in and of itself.

Appendix A:
INTERVIEW PROTOCOL - PHASE I

[Approaching the individual selected according to the systematic sampling procedure appropriate to the location, the researcher said:]

Hi, my name's Lynn and I'm working with the Bronx Zoo/Wildlife Conservation Park. We're looking for some visitors to help us develop new exhibits. Since this is very important to us, you'll receive a free animal key chain for your participation. It's a brief questionnaire for you to fill out. It only takes a couple of minutes. (You can do it while you're sitting here having lunch.) Would you be willing to help us?

[If "no"] Thank you anyway and enjoy your day.
("Refusals" and "refusals due to language" were recorded.)

[If "yes"] Great! I'll need the assistance of someone 18 years or older who is second from my left - that's you! Here you go (handing a pencil and the survey on a clipboard to the respondent) - there are four pages, but it should take only about five or six minutes to complete. You don't have to write your name anywhere on the form -it's completely anonymous. I'll give you a brief summary of page 2, since it can be confusing. [The appropriate instructions from below were included here.] I'll be standing over there (gesturing). If you have any questions, just signal to me.

[Instructions for the Gregorc Style Delineator:]

On the back here, it gives you columns of four words. What it asks you to do is put a "4" in the box above the word which is most like you, a "3" above the word which is next most like you, a "2," and then a "1" above the word which is least like you. You're supposed to think about the real, deep-down you. And react to your first impressions of the words. Even if you are not familiar with some of them - which is completely natural - still write a number in every box. But don't use the same number more than once in any column. And these boxes on the right you can just ignore.

[Instructions for the Learning Style Inventory:]

What it asks you to do is put a number in each of these spaces - you put a "4" in front of the phrase which is most like you, a "3" in front of the phrase which is next most like you, a "2," and then a "1" by the phrase which is least like you. Make sure you put a number in every blank, but don't use the same number more than once in any row.

Appendix A

[Upon receiving a completed survey from the respondent, the researcher would reply:]

How did it go? Did you have any questions about any of it? Well, thank you. I appreciate your taking the time to do this. You get to choose your animal [key chain] - I have a polar bear, a snow leopard, and a gorilla. Thanks a lot for participating!

Appendix B:
QUESTIONNAIRE - PHASE I & PHASE II

ID# ________

The Bronx Zoo/Wildlife Conservation Park is trying to create exhibits which visitors will find informative and interesting. To do this, we need to know a little about you.

Please circle the appropriate response.

You are: Male Female

Your age group is: 18-24 25-34 35-44 45-54 55-64 65-up

The last year that you completed in school is:

a. elementary school
b. some high school
c. high school graduate
d. technical school graduate
e. some college
f. college graduate
g. post-graduate

On the average, how many times each year do you visit a zoo?

less than 1 1-2 3-6 7 or more

Are you a member of The Bronx Zoo/Wildlife Conservation Society?

YES NO

PLEASE CONTINUE ON THE NEXT PAGE --->

For office use only:

Day ______________ Date ______________ Time __________

Exhibit ________________ Weather ______________________

Appendix C:
PHASE I & PHASE II: QUESTIONNAIRE - Page 3

ID# ________

Regardless of the exhibits you saw today, <u>in general</u> how appealing do you find each of the following types of exhibits?

From the scale pick the number which best represents your opinion and place it next to the item below.

6 - very appealing
5 - appealing
4 - somewhat appealing
3 - somewhat <u>un</u>appealing
2 - <u>un</u>appealing
1 - very <u>un</u>appealing

_____ a. signs telling facts about the animals

_____ b. signs which ask you questions, but only tell you the answer if you lift them or turn them over

_____ c. displays which give you an overview of an issue by presenting the conflicting points of view

_____ d. exhibits which allow you to try your own skills and experiment with something

_____ e. displays which include items you can touch

_____ f. displays which include silent videos or photographs

_____ g. displays which include recordings of information that you can hear

<u>NOT</u> counting yourself,
how many people are visiting the zoo with you today? _________

How many family members are visiting with you? __________

How many friends are visiting with you? __________

How many children are visiting with you? __________

What are the ages of the children? _________________________

Appendix D:
PHASE I & PHASE II: QUESTIONNAIRE - Page 4
ID# ________

How important are each of the following in deciding which exhibits to see today?

From the scale pick the number which best represents your opinion and place it next to the item below.

6 - very important
5 - important
4 - somewhat important
3 - somewhat <u>un</u>important
2 - <u>un</u>important
1 - very <u>un</u>important

_____ a. the Bronx Zoo map that you are carrying

_____ b. the directional signs located along the paths

_____ c. the interests of the children in your group

_____ d. the interests of the adults in your group

_____ e. the adults' opinions of what might be good for the children

This is the last question!
Congo Forest will be a spectacular new Bronx Zoo exhibit, featuring one of the largest gorilla habitats in the world. For an extra fee, visitors will travel through the jungle of West Africa, marveling at the elusive okapi, glimpsing troupes of mandrill and guenon monkeys, exploring the richness of this disappearing world. Besides discovering the secrets of forest animals and their way of life, visitors will find out how the Wildlife Conservation Society is working in Africa to save these species. The journey ends with a closeup view of gorillas, one of our most fascinating relatives. At the end of their exploration, visitors will have the opportunity to decide which Congo conservation project their entrance fee will support.

Considering the group you visit the zoo with, what is the maximum amount you would be willing to pay <u>per person</u> to enter this Congo Forest exhibit? (please circle)

less than $.50	$.50	$1	$2	$3	$4	$5	more than $5

THANK YOU VERY MUCH FOR YOUR HELP and
ENJOY YOUR DAY AT THE BRONX ZOO/WILDLIFE CONSERVATION PARK!

Appendix E:
PHASE I & PHASE II: QUESTIONNAIRE - Page 4

ID# ________

How important are each of the following in deciding which exhibits to see today?

From the scale pick the number which best represents your opinion and place it next to the item below.

6 - very important
5 - important
4 - somewhat important
3 - somewhat <u>un</u>important
2 - <u>un</u>important
1 - very <u>un</u>important

_____ a. the Bronx Zoo map that you are carrying

_____ b. the directional signs located along the paths

_____ c. the interests of the children in your group

_____ d. the interests of the adults in your group

_____ e. the adults' opinions of what might be good for the children

BEHIND THE SCENES!

Much of our conservation work happens behind the scenes, where few visitors are invited. Now, at our new Rare Bird Conservation Hub, you will be able to see how we develop techniques for saving endangered species. Our first focus will be waterbirds. Waterbirds are severely threatened by destruction of wetlands and by human activities like hunting. At the Rare Bird Conservation Hub, we will collaborate with wildlife biologists from countries like India and Brazil. We will learn to breed threatened species like Storks, Ibis, and Pelicans and discover ways to help them in the wild. For a separate admission charge, small groups of visitors will be permitted to tour this facility, to see our birds and our conservation program in action.

Considering the group you visit the zoo with, what is the maximum amount you would be willing to pay <u>per</u> <u>person</u> to enter the Rare Bird Conservation Hub? (please circle)

less than $.50	$.50	$1	$2	$3	$4	$5	more than $5

THANK YOU VERY MUCH FOR YOUR HELP and
ENJOY YOUR DAY AT THE BRONX ZOO/WILDLIFE CONSERVATION PARK!

Appendix F:
LEARNING STYLE ASSESSMENT INSTRUMENTS

David A. Kolb's revised Learning Style Inventory (LSI-1985) is a self-description questionnaire. It consists of 12 sentence stems, each of which has four endings. Each of the endings corresponds to one of the four learning modes - Concrete Experience (whose characteristic word is feeling), Reflective Observation (watching), Abstract Conceptualization (thinking), and Active Experimentation (doing). The respondent is asked to rank the endings according to how well each one fits with how the respondent would go about learning something. The LSI measures a person's relative emphasis on the four learning orientations and on two combination scores that indicate the extent to which the person emphasizes abstractness over concreteness and the extent to which s/he emphasizes action over reflection. The approximate administration time is less than ten minutes.

Research suggests the presence of a response-set bias for the standard LSI-1985 (Ruble & Stout, 1990, 1991; Sims, Veres, Watson, and Buckner, 1986; Veres, Sims, & Locklear, 1991) due to its single-scale-per-column format (i.e., the items are arranged in four columns with all items for a single scale in the same column). Therefore, the "scrambled" version of this instrument (which balances the number of times an item from a particular scale appears in each column) was utilized in this study.

Appendix F

The Gregorc Style Delineator (GSD) is a self-report instrument based on rank-ordering ten sets of four words. The respondent is asked to rank the words in each group according to which is the best and most powerful descriptor of one's real self. One word in each set represents one of the four learning styles: Concrete Sequential, Abstract Sequential, Abstract Random, and Concrete Random. A person's scores indicate the relative dominance of each of these styles. The administration time is approximately five minutes.

The following comparison will serve to distinguish the LSI and GSD instruments. The two associated learning style theories, which each result in a quaternary style typology, hold one dimension (represented pictorially by a bipolar axis) in common: perception (i.e., the grasping of information). This axis, in both theories, is a continuum running from concrete to abstract. Kolb's second dimension (i.e., the axis perpendicular to perception) is transformation (i.e., the processing of information). This axis has as its endpoints active experimentation and reflective observation. In contrast, Gregorc's second dimension is "ordering" (i.e., the ways information is arranged, systematized, referenced, and expressed). This continuum runs from sequential to random.

Appendix G:
INTERVIEW PROTOCOL - PHASE II

[Visitor groups arriving at the table inquiring about the Congo Rain Forest Conservation Trail were greeted by the researcher:]

Hi, are you looking for the Congo Rain Forest Conservation Trail?

[If "yes"] Well, you've found it - this is it. Just give me a moment to explain. There's some good news and some bad news. The bad news is that the Conservation Trail has not been constructed yet; the good news is that this doesn't cost anything. What we're doing today is trying to get visitor input into the design process at this early stage. The new gorilla exhibit is going to take up this whole area (pointing to the South America section on the zoo map). It is the largest and most expensive project the zoo has ever undertaken. That's why we'd like to get visitor suggestions now before the full-blown project is built - so that there's more of a guarantee of it being successful with visitors.

What I have is a survey that takes about five or six minutes to complete. But you'll receive either a free gorilla key chain - that looks like this (displaying one) - or a cat poster that looks like this (unrolling an example). It is completely anonymous. Would you be willing to take a moment to do this?

[If "no"] Thank you for stopping to inquire; enjoy the rest of your day.
("Refusals" and "refusals due to language" were recorded.)

[If "yes"] Great. Well, I need one person to do this, who is 18 years or older and second from my left - that's you! This is the survey I'd like you to fill out (handing a pencil and the survey on a clipboard to the respondent). Please sit down. I'll give you a brief summary of what it's asking you to do on the second page so that it will go more quickly for you. [Instructions appropriate to the learning style assessment instrument were given.]

[The researcher described the proposed gorilla exhibit, using the artistic renderings and the designers' floor plans either (1) before the participant began the survey if s/he was interested in hearing about it first; or (2) while the participant was completing the survey, if the other group members were interested; or (3) after the participant had finished the survey.]

Appendix G

[To the other group members:] There are a couple of other suggestion forms here that only take a moment to complete - if you'd like to take a look at them. [Instructions for the specific surveys were given if the visitor seemed interested: one survey asked visitors to vote for a name for the new gorilla exhibit, one asked what topics related to gorillas visitors would be interested in learning about, and one asked visitors to choose from a list those words which they believed described gorillas.]

[When the participant had finished the survey, the researcher replied:]

How did it go? Did you have any questions about any of it? Thank you very much. I appreciate your taking the time to do this. Would you like the gorilla key chain or the cat poster? Thank you - enjoy the rest of your day!

Appendix H:
BABOON RESERVE INTERPRETIVES

(From the left side of the display to the right)

First text panel:

LIFE ON THE ROCKS

Rock hyraxes avoid predators by living on steep cliffs and rocky outcrops.

What is a hyrax?
Hyraxes are not rodents or rabbits. Social rock dwellers which make loud savage cries, they have no close relatives.

Sun bathers
Hyraxes are often found huddled together basking on rocks because they have difficulty maintaining body heat.

Adaptations
Long tactile hairs help hyraxes orient in dark crevices and burrows, and their foot pads contain sweat glands that enhance traction when climbing.

Hyrax at home
Hyrax colonies are made up of family groups, each with a dominant male. They range from 25 to 60 animals. One old, especially alert male seems to "lead" the whole colony.

Rock Hyrax   Procavia capensis
Diet: Various plants and grasses
Weight: 10-15 pounds
Habitat: Steep cliffs, rocky outcrops or kopjes
Range: Throughout Africa, south of the Sahara
Life Span: 9-12 years
Gestation: 205-245 days
Number of young: 1-6 (average 3.2)

TWO TELESCOPES

Second text panel:

GELADAS ARE SPECIAL
A different kind of baboon

Most baboons are omnivorous; only geladas eat grass as their main diet.

Appendix H

All baboons use their rumps for displays; only geladas utilize their bare chests [sic] patches to convey messages.

All baboons are vocal; only geladas use as many as 25 different calls to communicate.

Most baboons live in woodlands and savannas; only geladas live on high altitude grasslands.

Gelada *Theropithecus gelada*
Diet: Predominantly grass, some leaves and fruit
Weight: Male: 65-80 pounds Female: 25-45 pounds
Habitat: Mountain gorges and grassy plateaus
Range: Ethiopia
Life Span: 20 years
Population: 500,000 animals
Gestation: 154-185 days
Number of young: One

Question and answer lift panels: [1] [2] [3]

[4] [5] [6]

1. When a gelada looks you in the eye, is she being polite? [Lift]
   No. To a baboon, direct eye contact is an act of hostility - a threat.

2. When a gelada smiles, is she being friendly? [Lift]
   Unlike a person, a baboon smiles to show fear or appeasement.

3. When a gelada yawns, he's not sleepy. [Lift]
   Unlike a person, a gelada yawns to show off his large canine teeth. It is a way to display his aggression.

4. What does it mean when a gelada flips his lip? [Lift]
   He is worried, or uncertain, or something...

5. When geladas groom each other, they are... [Lift]
   not picking fleas. They are cleaning and comforting each other. Grooming maintains social bonding.

6. When a gelada turns her back, she's not being rude. [Lift]
   Unlike a person, a baboon does this as an act of submission.

Appendix H

Third text panel:

WHAT IS A BABOON?

Eight species of large, social, ground-dwelling African monkeys are called baboons.

Elaborate behavior
Baboons are easily observed. Much of what we know about primate behavior comes from baboon studies.

Big baboon!
Next to the great apes and human beings, baboons are the largest of all primates.

Life on the ground?
Large size, formidable canine teeth and a cohesive society helped make life on the ground safe for the baboon's ancestors.

Primarily vegetarians
Most baboons are vegetarians, especially the gelada. Some, such as the olive baboon have been known to prey on birds and small antelope.

Lift panel: Can you tell how old an ibex is by its horns?

> Experts can "age" ibex by counting annual growth rings. Horn growth is slower in winter when food is scarce - making narrower rings.
> (Illustration under lift: two ibex horns with rings numbered; #6* - *note prolonged period of poor nutrition in sixth year.)

Two touchable ibex horn replicas (large and small)

Fourth text panel:

A HERD OF BACHELORS

Nubian ibex typically associate in single sex herds.

Separate lives
Adult male and female herds live apart from each other for most of the year, coming together only during the breeding season.

Appendix H

<u>A show of strength</u>
Within bachelor herds, dominance hierarchies are established through gesturing, threats, and actual fighting. This aggression intensifies prior to the breeding season. The dominant male will breed most of the females.

<u>Juvenile males</u>
Young males leave their mothers [<u>sic</u>] group at the age of two or three to join all-male herds.

<u>Adult males</u>
Adult males can be identified by their longer, more massive horns, and goatees.

Nubian Ibex <u>Capra ibex nubiana</u>
Diet: Grasses and shrubs
Weight: Up to 200 pounds
Habitat: Rocky desert regions from sea level to 9,000 feet
Range: Northeast Africa to Arabia
Life Span: 15 years
Population: 2,000 individuals
Gestation: 150-180 days
Number of young: One, occasionally twins

Glass-enclosed bulletin board:
contains map and articles (about Ethiopia) and the following sign -

THREE HAREMS IN ONE EXHIBIT

<u>Look</u> for the three harems of geladas that are here. Only social and psychological barriers separate them.

<u>Watch</u> for interactions between the large males from each harem as they defend their females and territories.

<u>Note</u> how the females and young strengthen their group bonds as they groom one another and the male.

<u>Can you find the three harems?</u>

Appendix I:
HIMALAYAN HIGHLANDS INTERPRETIVES

The post at each entrance: Snow Leopard
Predator of the high Himalayas.

First "table" with three rotating panels:

SNOW LEOPARD SURVIVAL...CONFLICTING VIEWPOINTS
Around the world, the survival of rare animals such as the snow leopard is threatened by conflicting human needs. Each side has a genuine concern. The issues are not simple and wildlife survival depends upon their resolution.

First rotating panel:

...neither man nor wildlife
...George Schaller, WCI Conservationist

"Much of the snow leopard's harsh environment is now unsuitable for humans. Because of overgrazing by livestock, the land erodes to where it can support neither man nor wildlife."

Competing for food
...a Tibetan farmer

"Life is hard. There is little grazing so our goats remain thin, and the farming is poor. With little food we hunt wild game; it is more important for us to eat than for the snow leopard to eat."

Second rotating panel:

Strengthening the laws
...a Chinese government official

"We have made some progress in getting wildlife laws passed, but laws must be enforced in order to be effective."

Unenforceable laws
...a Kirghiz policeman's wife

"Our law protects the snow leopard. But my husband is a policeman and he must patrol a huge area. If he finds someone with a skin, how can he prove the animal didn't die naturally?"

Appendix I

Third rotating panel:

Protecting my herds
...a Kirghiz shepherd

"Snow leopards killed three of my goats last year. All I have is 30 goats. To protect them I must kill the cats."
Would you give up 1/10 of all you own to save snow leopards?

Seeking outside help
...George Schaller, WCI Conservationist

"Killing by locals has exacted a devastating toll on snow leopards, even in refuges. But these are poor people. We must offer help and understanding for the snow leopard <u>and</u> the people."

Second table:

RESEARCH IN NEPAL

Since 1970, NYZS/The Wildlife Conservation Society has supported research on snow leopards in the Himalayas. The nature of the terrain and of the species make snow leopard sightings rare. Only with the aid of radio tracking can these elusive predators be studied.

Over a four-year period, Dr. Rodney Jackson radio-tracked five leopards in Nepal. His work has revealed much about their solitary nature, their elaborate system of scent-marking and ground-scraping as means of finding and avoiding each other, and their staggered use of shared territory.

Excerpts from Rodney Jackson's Diary:

1/2/82 We are snowbound at the entrance of the study area...Langu Gorge.

6/30/82 No contact for four days now with 964. We retire...by the entrance to the cave - our temporary home.

3/24/82 ...snowbound...for almost three months.

Appendix I

4/3/82 The world's first radio-collared snow leopard is on the move. Strong beep...tells me he is heading east...I can hardly believe our good fortune - to have trapped one of the earth's rarest living creatures on the very first try.

7/3/82 11 P.M. An hour ago, I picked up 964 on Tillisha Mountain...I'm settled in for a night of monitoring.

7/11/82 Cat 964...beyond our range in Takla Khola...a deep avalanche gully blocked my way. I turned back, scanned the slopes...a form on top of a promontory...unmistakable ...a snow leopard!

7/12/82 I returned to Pukchang this morning and again crossed The Cliff. It is becoming less awesome; today I looked down...

7/13/82 Today cat 964 has remained...he spent all last night there, too...I suspect he has a kill.

7/15/82 ...a small cat...in broad daylight had followed our tracks up the gorge. I knew it watched us, unseen, as we walked...

8/11/82 ...I climbed the saddle...at 16,500 feet, overlooking the Mugu and Chapa Valleys...searched in vain for snow leopard sign...

12/15/82 ...the second snow leopard is collared...Perseverance paid off.

Touchable collar mounted on table with the following description:
Size #4 radio collar, used for tracking snow leopards.

Photo title: Dr. Jackson works quickly to place a radio collar on a tranquilized cat.

Map title: Snow leopard tracked over a six-week period.

Map: Grid overlaid with points representing sightings and arrows between points for the path taken - four points labeled: "base camp," "start," "on known kill," "on presumed kill." Scale showing 0, 1000 feet, and 1 mile - distance.

Appendix I

Third table:

WILDLIFE CONSERVATION INTERNATIONAL

W.C.I. - a division of the New York Zoological Society - is the oldest and most broadly focused international conservation organization in America. Field research is being conducted around the world from the Himalayas and the African savannas and rain forests to the Argentine coasts by such notables as W.C.I. field scientists George Schaller, David Western, Tom Struhsaker, and others.

Since 1897, W.C.I. has undertaken more than 400 conservation projects in more than 60 countries and has helped establish more than 60 national parks and nature reserves worldwide.

Help W.C.I. save wildlife
Please write Wildlife Conservation International, Bronx, N.Y. 10460, or telephone (212) 220 5090.

World map: CONTRIBUTIONS OF WCI TO CONSERVATION

(The following phrases are scattered around the map:)

Returning bison to the west
Regulating importation of crocodile skins
Studying snow leopards
Studying okapis
Saving komodo monitors
Saving giant pandas
Saving jaguars
Studying magellanic penguins
Studying right whales
Discovering the songs of whales
First studies of mountain gorillas
Conservation of African rhinos
Conservation of African elephants
Stopping importation of birds-of-paradise plumes

Dots located on the map:
[green dot] Conservation projects
[pink dot] WCI established nature reserves

Appendix I

HANGING QUOTATION PANEL

"Why not love all living beings, as members of the universe?"
- the Path of Light, Buddhist writings

Buddhism is a prominent religion in the Himalayas. WCI* is researching Buddhist teachings to compile specific references in support of conservation. By appealing to religious beliefs, these quotes may help curtail the killing of threatened wildlife by the local people.

<u>Prayer Stones - Prayer Flags</u>
Followers of Buddhism embellish stones and flags with prayers and religious images. They believe that the action of wind and rain carries the prayers to heaven.

*Wildlife Conservation International

Appendix J:
INTERVIEW PROTOCOL - PHASE III

[Approaching the visitor group selected according to the systematic sampling procedure, the researcher said the following:]

Hi, my name's Lynn and I'm working with the Bronx Zoo/Wildlife Conservation Park. We're looking for some visitors to give us their opinions of an exhibit around the corner here. Since this is very important to us, you'll receive a free animal key chain for your participation (researcher shows the key chain). It's an anonymous survey. Would you be willing to help us?

[If "no"] Thank you anyway; enjoy your day.
("Refusals" and "refusals due to language" were recorded.)

[If "yes"] Great. I'll need one person to fill this out who is 18 years or older and second from my left - that's you! While we're here, I just need for you to fill out the front page (hand survey form on clipboard with pencil to the respondent) - it will only take a second. Then I'll take you around the corner to what I'd like for you to look at. Afterwards there's a questionnaire that takes about five minutes for you to give us your opinions.

[After the respondent finished the front page, the researcher collected it.]

Now I'll take you to what I'd like for you to look at (walking with the group). When we get there I want you to act just as you do with all zoo exhibits - if you look, look; if you read, read; do whatever you do naturally.

[Upon arriving at the Baboon Reserve test alcove:]

Okay, this is the area I'd like for you to take a look at - everything from the bulletin board on the right to the last sign on the left - look at whatever you're interested in and when you're done just let me know.

[Upon arriving at the snow leopard display:]

I should tell you that there is no animal here, so don't spend your time looking for one. It's just this sign posted here (gesturing) and these three tables. Look at whatever you're interested in and when you're done, just let me know.

[Researcher recorded observational data while the respondent was at the interpretives.]

Appendix J

[When the respondent had finished at the display:]
Okay, now we'll just head up this way for you to finish writing out the survey.

[Upon arriving at the fossil dig area in the Baboon Reserve or the snow leopard/red panda area of the Himalayan Highlands, the researcher handed the participant the clipboard with survey form and pencil and explained the instructions for completing the learning style instrument.]

[When the respondent had finished with the learning style instrument:]
Okay, now the rest of the questions refer just to that little area I asked you to look at.

[When the respondent approached the informational recall section of the survey:]
For the rest of the questions, try your best to answer them, but if you can't remember or whatever, just put a question mark in the blank so that at least I know you looked at it.

[Upon receiving a completed survey from the respondent, the researcher replied:]
Thank you very much for taking the time to do this. I really appreciate it. You get to choose which animal you'd like (displaying the key chains) - I have a gorilla, a polar bear, or a snow leopard. Thanks so much!

Appendix K:

INITIAL SURVEY- PHASE III

ID# ________

Please tell us a little about yourself by circling the appropriate response.

You are: Male Female

Your age group is: 18-24 25-34 35-44 45-54 55-64 65-up

The last year that you completed in school is:

a. elementary school

b. some high school

c. high school graduate

d. technical school graduate

e. some college

f. college graduate

g. post-graduate

On the average, how many times each year do you visit a zoo?

less than 1 1-2 3-6 7 or more

Are you a member of The Bronx Zoo/Wildlife Conservation Society?

YES NO

NOT counting yourself,
how many people are visiting the zoo with you today? ________

How many family members are visiting with you? ________

How many friends are visiting with you? ________

How many children are visiting with you? ________

What are the ages of the children? ________

For office use only:

Day ________ Date ________ Time ________

Exhibit ________ Weather ________

Appendix L:
UNOBTRUSIVE OBSERVATION RECORDING FORM - PHASE III:PART B

ID# ________

Group size = A: _______ + C: _______ = _________

Start Time _____________

Behavior	Occurrences with						Total
	panel (4)	tele	lift (6)	horn	bul	anim	
Look at graphics		--- --- ---				--- --- ---	
Read aloud		--- ---				--- ---	
Talk w/ adult							
Talk w/ child							
Show adult							
Show child							
Manipulate alone	----- -----			h l	--- ---	--- ---	
Manipulate w/ adult	----- -----			h l	--- ---	--- ---	
Manipulate w/ child	----- -----			h l	--- ---	--- ---	
Watch someone manipulate	----- ----- -----			h l	--- --- ---	--- --- ---	

Groups passing by: _________________________

End Time _____________

Appendix M:
UNOBTRUSIVE OBSERVATION RECORDING FORM - PHASE III:PART H

ID# ________

Group size = A: _______ + C: _______ = _________

Start Time ____________

Behavior	Occurrences with				Total
	flips (3)	collar	map	quote	
Look at graphics					
Read aloud					
Talk w/ adult					
Talk w/ child					
Show adult					
Show child					
Manipulate alone			----- -----	----- -----	
Manipulate w/ adult			----- -----	----- -----	
Manipulate w/ child			----- -----	----- -----	
Watch someone manipulate			----- -----	----- -----	

Groups passing by: ________________________

End Time ____________

Appendix N:
FOLLOW-UP QUESTIONNAIRE - PHASE III: PART B

ID# ________

The Bronx Zoo/Wildlife Conservation Park is trying to create exhibits which visitors will find informative and interesting. You can help by telling us what you think.

NOT including the live animals, which part of the display did you like best?

Did you learn anything from the display? YES NO

If YES, what did you learn?

If NO, was there a reason that you didn't learn anything?

PLEASE CONTINUE ON THE NEXT PAGE --->

Appendix N:
Questionnaire - Phase III: Part B

ID# ________

For the next five questions, use the following scale.

6 - very appealing
5 - appealing
4 - somewhat appealing
3 - somewhat unappealing
2 - unappealing
1 - very unappealing
0 - I did not look at it

Pick the number which best represents your opinion and place it next to the item below.

In the exhibit you just viewed, how appealing did you find:

______ a. the telescopes

______ b. the horns that you could touch

______ c. the question panels which you lift to find the answers

______ d. the written messages on the signs

______ e. the glass-enclosed bulletin board

For the next 3 questions, choose your answers from this list of animals:

Baboon Hyrax Monkey Gelada Mountain Goat Ibex

From the exhibit you just viewed,

Which animal lives in single sex herds? ____________________

Which animal spends most of its time on rocks? ______________

Which animal is a specific type of baboon? __________________

PLEASE CONTINUE ON THE NEXT PAGE --->

Appendix N:
Questionnaire - Phase III: Part B

ID# ________

In what country might you see wild geladas? ____________________

How can you tell the age of an ibex?

True or False:
Just like a person, a gelada will look you in the eye to be polite, smile to be friendly, turn its back to be rude, and yawn when sleepy.

(Please circle one) --> TRUE FALSE

THANK YOU VERY MUCH FOR YOUR HELP and
ENJOY YOUR DAY AT THE BRONX ZOO/WILDLIFE CONSERVATION PARK!

Appendix O:
FOLLOW-UP QUESTIONNAIRE - PHASE III: PART H

ID# ________

The Bronx Zoo/Wildlife Conservation Park is trying to create exhibits which visitors will find informative and interesting. You can help by telling us what you think.

Which part of the display that you just viewed did you like best?

Did you learn anything from the display? YES NO

If YES, what did you learn?

If NO, was there a reason that you didn't learn anything?

PLEASE CONTINUE ON THE NEXT PAGE --->

Appendix O:
Questionnaire - Phase III: Part H

ID# ________

For the next five questions, use the following scale.

6 - very appealing
5 - appealing
4 - somewhat appealing
3 - somewhat <u>un</u>appealing
2 - <u>un</u>appealing
1 - very <u>un</u>appealing
0 - I did not look at it

Pick the number which best represents your opinion and place it next to the item below.

How appealing did you find:

______ a. the rotating panels which tell the views of different people

______ b. the device used to track snow leopards

______ c. the diary excerpts about tracking a snow leopard

______ d. the world map listing various conservation projects

______ e. the sign with the quotation from Buddhist writings

Snow leopards are rarely seen. What device has allowed these animals to be studied in the wild?

____

What was the name of the conservation organization mentioned on the signs?

____

What general message did **you** get from the rotating panels?

____
____
____

THANK YOU VERY MUCH FOR YOUR HELP and
ENJOY YOUR DAY AT THE BRONX ZOO/WILDLIFE CONSERVATION PARK!

Appendix P:
DEFINITION OF OBSERVATIONS FOR THE BABOON RESERVE

Look = The participant remained stationary with head directed toward one of the text panels, the lifts, the mounted horns, or the bulletin board.

Read aloud = The participant read aloud text from one of the panels, the lifts, or the bulletin board.

Talk with adult = The participant talked with an adult while interacting with one of the exhibit components.

Talk with child = The participant talked with a child while interacting with one of the exhibit components.

Show adult = The participant pointed at something or said, "Look..." to direct the attention of an adult.

Show child = The participant pointed at something or said, "Look..." to direct the attention of a child.

Manipulate alone = While alone, the participant manipulated the telescope, lifted the lift panels, or touched a mounted ibex horn.

Manipulate with adult = With an attentive adult, the participant manipulated the telescope, lifted the lift panels, or touched a mounted ibex horn.

Manipulate with child = With an attentive child, the participant manipulated the telescope, lifted the lift panels, or touched a mounted ibex horn.

Watch someone manipulate = The participant looked in the direction of another visitor who was manipulating a telescope, lifting a lift panel, or touching an ibex horn.

Appendix Q:
BABOON RESERVE OPEN-ENDED SURVEY QUESTION #1 - VERBATIM RESPONSES[47] CONTENT-ANALYZED

Not including the live animals, which part of the display did you like best?

SCENERY/NATURAL ENVIRONMENT/PHYSICAL SURROUNDINGS (33)[48]
405 Natural environment
412 The feeling the animals were free, we were in the cage
414 The building and formation itself. The grounds depicted the feeling to which it was directed towards - good job!
416 The scenery
424 Habitate
427 The scenery was neat. I liked the rock formation
428 Natural setting...
429 The setting and the habitat created for the live animals
433 Landscape
436 The setting
441 Physical lay-out of display, ex: rocks, water
443 The primitive style
451 The rock garden
455 ...Natural surroundings without cages
506 The environment, replicating a natural environment made me feel as if I was somewhere other than N.Y.
508 Habitat & environment
509 Background
510 Habitat
511 Habitat &...
520 The grassland & rocks
524 Rocks with hyraxes
535 Rock structures
545 The way it was layed out
547 The fact that setting appeared natural
550 The surroundings
551 Naturalness of the setting
553 Layout
557 The environment
559 The rocks and greenery
562 The scenery

---

[47]Please note the following: (1) Grammatical/spelling errors have been retained in all verbatim responses. (2) A word surrounded by "~ ~" indicates that the word is a guess because what was written was difficult to decipher. The same symbol (~ ~) with empty space between indicates that what was written was completely illegible.

[48]The number of responses is enclosed in parentheses.

Appendix Q

<u>SCENERY/NATURAL ENVIRONMENT/PHYSICAL SURROUNDINGS</u> (33)

p402 I like best the baboons because they have a lot of space and trees

p502 The rocks

p504 The little caves for the little animals to catch up on some fresh air

<u>THE TEXTUAL SIGNS</u> (22)

409 Small signs with brief explanations

411 Observation windows informative reading material

418 The write-up explaining the animals and other facts

421 The history on plaques describing environment,eating habits,etc

434 I liked the brief descriptions of the various animals which were <u>supposed</u> to be in the exhibit and particular their lifestyles

437 The clearly explained animals that were inside - how they lived, ~eat~ etc

438 The information provided in the descriptions of the animals & their habitats;...

439 The plaques describing the animals

440 Reading and learning new things

442 I like reading about the habits of the animals & how they treat their young

450 Brief, written description of animals - their habits, etc

458 The bulletin boards with info about the animals

459 The written materials,...

512 The descriptions of the animals displayed

518 Short descriptions of animals/origins

521 Information boards/panels

526 Displays in front of the animals that told you a little bit about them

536 The information signs under the windows were the best even including the live animals

537 Information signs

548 Species description

555 Written descriptions

p404 The information that is categorized separately, e.g., weight, food, habits

<u>THE PARTICIPATORY LIFT PANELS</u> (16)

406 ...helping him ["my child"] pretend to be a gelada by mimicking the behavior in the lift up display

419 The learning flip charts of items to learn about the exhibit

422 Lift panels - very informative

423 Description panel with wooden lids for Q & A

Appendix Q

<u>THE PARTICIPATORY LIFT PANELS</u> (16)
432 Flip charts
438 ...Also the questions & answers about the baboons
452 The questions with answers
454 The questionnaire [question panels?]
457 The flip questions/answers
459 The written materials, especially the Q/A boxes
514 The question & answer panel
522 ...the flip quizzes
539 The questions and answers
543 Question & answer plaques
554 Question boxes that you lift to find the answer
p503 The questions & answer displays

<u>THE INFORMATION, IN GENERAL</u> (16)
415 Information about the animals
426 The information
446 The information given about the animals
448 Descriptive information on the exhibit
449 The information pieces and...
453 Information for children
505 ...Information...
511 ...the information about the animals
523 History of animals
529 Information in display
532 The information given
542 The information about the animals
544 Info
552 Information regarding Ethiopia
p401 Information
p501 The information provided about the animals

<u>THE TELESCOPES</u> (8)
406 Helping my child look thru the telescope & ...
407 The telescope
417 The telescope so you can see better
449 ...the telescope
460 The telescope
540 The telescope is a great idea, but hard for the little ones to find their "targeted" animal
546 Telescopes
560 Telescopes

Appendix Q

<u>THE MOUNTED IBEX HORNS</u> (7)

420 Telling how old they were by looking at their horns
447 The exhibit about telling how old they were by the horns
519 Tells how to tell age by counting rings on horns
522 The antlers on the edge and...
530 The horns
533 The horns on the exhibit and the information about them
558 Horns

<u>THE DESIGN OF THE EXHIBIT</u> (5)

428 ...Good view of entire area
455 The closeness of animals allowed to approach...
516 The display was set up nicely
541 The open air display up close and personal
561 Wide view of exhibit

<u>THE LIVE ANIMALS</u> (3)

444 I only saw the ibex
505 ... Geladas & goats
517 Disappointed that animals were not present

<u>MISCELLANEOUS REPLY</u> (7)

410 All
413 How care is done [Spanish speaker]
425 The skull & bones
431 Didn't pay much attention
505 Displays...
507 Nothing
515 The displays of ~monkey~ behavior

Appendix R:
BABOON RESERVE OPEN-ENDED SURVEY QUESTION #2A - VERBATIM RESPONSES CONTENT-ANALYZED

Did you learn anything from the display? YES NO

If YES, what did you learn?

<u>LEARNED FROM THE PARTICIPATORY LIFT PANELS</u> (27)

414 Baboons turn their backs on you as an act of submission
419 About the baboons & what they do to display emotion
420 That the baboons expressions don't exactly mean the same as ours
423 Emotional values that are connected with specific visual cues - Gelada
428 Baboons are showing their teeth when they yawn
438 I learned about baboon behavior ["questions & answers about the baboons" was mentioned as one of her best liked parts]
449 ...Baboons don't like to be stared at because it's an act of aggression. They do like to stroke each other as part of bonding
453 How baboon's reaction are and differ
454 Behavior of the bamboon family
457 Smiling is a sign of fear, not joy
458 Baboons actions and results; questions panels
459 Behavioral aspects/signs of the baboons,...
505 Behavior of geladas...
506 The animal I didn't see (Gelada), relative of Baboon, smiles when he feels fear
514 When baboons stare it is a threat
517 Liked the flip cards
520 ...The baboons expressions show fear, hostility, submission
521 How behavior is expressed by the geladas
534 The real reason for some of the most common behavior of baboons (grooming, smiling, etc)
540 ...The monkeylike animal turns its back as a sign of submission; It "smiles" to show its teeth (an aggressive display); It grooms each other as a comforting act
546 Baboons smile when scared; Female baboons turn their back for submission
552 Baboon habits & demonstrative characteristics
553 Info on baboons - how they react to each other
554 When an animal turns its back to me it is a sign of submission
558 What the baboon displays mean
559 How the baboons show dominance, etc.
p503 How the different mannerisms are usually interpreted but do not necessarily mean the same thing to the animals

Appendix R

<u>TEXTUAL SIGN INTERPRETED AS INTENDED</u> (20)

415 How they live, what they eat, how long they live, etc
418 I learned about a new animal I had never heard of - the Hyrax
426 The lifestyle of the animal, which will enable me to observe their behavior better
427 That the males are recognized by their longer goatees; The little things in the rocks make loud screeching noises
434 The social and eating habits of the baboons and hyraxes
436 Names of different animals
446 I learned some general information on the animals
448 Some knowledge of baboons and other animals in the exhibit
449 ...& males have goatees...
450 Geladas are vegetarian; Ibex gather in single-sex groups; Hyrax - new to me!
518 Ibexes travel in single sexed herd
520 The animals live in single sex groups;...
523 How the goats (ibex) mate
535 Ibex are single gender pack animals; The baboons displayed were unique in 4-5 ways; exposed to hyrax's (?)
536 Ibex live in segregated herds except when mating
539 That ibex live in single sex herds
540 The "goat like" animals live generally in single sex groupings;...
560 Baboons eat meat;...
p404 The sizes of the animals & the foods they ate
p501 What baboons eat etc

<u>MISINTERPRETATION OF TEXTUAL MESSAGE</u> (8)

425 That the gelada are omnivorous
442 Baboon's young are very independent. The young leave there mother's at 2 or 3 yrs old. Males & females live apart.
508 Mountain goats live in groups, segregated by sex
530 Geladas only eat grass
537 Ibex are often born twins
547 Baboons larges primates besides man;...
548 Simply, that what looked like a mountain goat is a bachelor
557 Hirax - I learned that hiraxes protect themselves from predators by living in holes

Appendix R

LEARNED FROM THE MOUNTED IBEX HORNS (12)

432 Ibex age determined by horn size
447 How to tell how old they were
449 About the horns on the ibex...
459 ...Age rings of ibex horns
511 ...and how to tell their age
519 How to tell their age
522 You can tell age by the antlers
533 I learned that they can age an animal by looking at the rings of its horns
540 ...You can tell their age by the rings on their horns;...
543 Rings on antlers show age
547 ...Ibex - can tell age via horns
562 To tell ages

LEARNED FROM THE LIVE ANIMALS (7)

406 It's not the first time we done this, but we've learned about gelada behavior from watching them
416 That the animals, unlike other animals I say stayed together
455 Some animals are relaxed around humans; Many animals live together in peace
505 ...Interaction of geladas & goats...
560 ...Ibex's like shade
p401 Red marking on baboon
p402 I had never seen a baboon before. They look different

MISCELLANEOUS LEARNED INFORMATION - REFERENT DISPLAY IS AMBIGUOUS (26)

407 Different types of animals
411 Learned about animals that I haven't seen before
417 How animals live together
421 Apes mimic primary civilization
422 About the series of events around you - skulls, droppings, etc
431 Different kinds of animals living in this area of the world
433 How the animal live
437 How different some animals live, and react with world around them
439 Saw some size of the horns and different types of baboons
440 About the animals behavior; Things I didn't know before
441 Different cohabitation & areas which different animals live
443 Human kind learn from the past or history
505 ...Type of terrain inhabited by animals
511 How they behave and why,...

Appendix R

<u>MISCELLANEOUS LEARNED INFORMATION - REFERENT DISPLAY IS AMBIGUOUS</u> (26)

512 Learned about the social interactions of baboons
515 The habitat on which the baboons live
529 The animals characteristics
541 Animal social orders even in diverse species in one habitat to survive
542 I learned about the animal habits, and their surroundings
544 About the animals
545 How different animals interact with each other
550 Biology, zoology, habits, development
555 Lifestyle of animals
561 Existence of the animals on display
p502 Different behavior of baboons
p504 Many animals get alone

Appendix S:
BABOON RESERVE OPEN-ENDED SURVEY QUESTION #2B -
VERBATIM RESPONSES CONTENT-ANALYZED

If NO, was there a reason that you didn't learn anything?

NO LIVE ANIMALS WERE VISIBLE (5)
405 Didn't have chance to observe animals
435 There is not much to see
444 I didn't see anything
507 No animals present
537 There was only one animal from the information signs visible today

VISITOR WAS WITH A CHILD (4)
409 Busy with my kids
506 Mostly, having a young child, 2 [yrs old] with me is very distracting so that even though I read the displays I don't focus very well on the information
516 No, because I was trying to let my children take a look at the animals
551 Too busy (with a child)...

VISITOR DID NOT READ (4)
451 Just watching, not reading
452 I wasn't reading everything
460 Just observed the animals - I didn't read information
526 I didn't read the entire thing

VISITOR ALREADY KNEW THE INFORMATION (3)
429 Much of the information given on the display are facts presented again & again on wildlife shows on TV and in magazines
524 Because I already knew
551 ...and had previously visited

MISCELLANEOUS REASON FOR NOT LEARNING (3)
412 Some small things were observed, nothing of consequence
510 I didn't pay close attention
532 No

Appendix T:
DEFINITION OF OBSERVATIONS FOR THE HIMALAYAN HIGHLANDS

Look = The participant remained stationary with head directed toward one of the tables or the hanging sign.

Read aloud = The participant read aloud text from one of the exhibit modules.

Talk with adult = The participant talked with an adult while interacting with one of the modules.

Talk with child = The participant talked with a child while interacting with one of the modules.

Show adult = The participant pointed at something or said, "Look..." to direct the attention of an adult.

Show child = The participant pointed at something or said, "Look..." to direct the attention of a child.

Manipulate alone = While alone, the participant flipped one of the rotating panels or touched the mounted radio collar.

Manipulate with adult = With an attentive adult, the participant turned one of the flips or touched the mounted radio collar.

Manipulate with child = With an attentive child, the participant turned one of the flips or touched the mounted radio collar.

Watch someone manipulate = The participant looked in the direction of another visitor who was rotating a flip or touching the mounted radio collar.

Appendix U:
HIMALAYAN HIGHLANDS OPEN-ENDED SURVEY QUESTION #1 - VERBATIM RESPONSES[49] CONTENT-ANALYZED

Which part of the display that you just viewed did you like best?

THE ROTATING PANELS (39)[50]
609 Different people's opinion [table w/ flips]
611 The things that turned
612 The part of display - that compared different cultural viewpoints
616 About the opinions of hunters on how survival is best, and about how people are dealing with nature and its adventures
617 Need more detail on all specimens [He liked the 3 flip table best, but thought it needed more detail for those people who would like to know more]
618 Faces and different views
621 I learned that snow leopard it is spices endengenous and it is fight between the conservation and common people [native Polish speaker]
634 Comments from indigenous people...
637 I liked the part that the different persons told their opinion about saving the leopard or not,...
639 The different points of view
640 The display where you turn the pictures
642 The items that flipped over
644 The first section dealing with reasoning for & against the hunting of snow leopards
646 The faces with the quotes
648 The turning men
650 Flip pictures...
653 Three boards (heads)
654 The conflicting viewpoints
657 Opposite views
659 First - people that flipped
660 The spinning display (first part)
709 The view points (flipping)

---

[49]Please note the following: (1) Grammatical/spelling errors have been retained in all verbatim responses. (2) A word surrounded by "~ ~" indicates that the word is a guess because what was written was difficult to decipher. The same symbol (~ ~) with empty space between indicates that what was written was completely illegible.

[50]The number of responses is enclosed in parentheses.

Appendix U

THE ROTATING PANELS (39)

718 I was interested in the section that had quotes of real people
723 The stone explaining the difference of opinion on the snow leopards
725 The pros & cons of protecting the animals
731 Different opinions by the people that live in the area
732 Snow leopards, view of the three diff people
735 The written display with faces that spin
738 The part with the people where you flip them over and you get different ideas & views
741 Killing goats
744 The one that inform about the extinction of the snow leopard [flip board]
746 The information about the people
749 Points of view about wildlife
758 The display with the turn style pieces
759 The opposing viewpoints of the need to kill the snow leopard vs save him
760 Opposing views turn-a-bout
p605 ...the conflicting viewpoints were fascinating
p705 The part where you could read why snow leopards are in danger and views of people
p706 The display depicting the people and their opinions

THE RADIO TRACKING DISPLAY (32)

614 The one with the tracking system
619 I liked the collar tracking snow leopard's exhibit part
624 The radio collar used to track cats
626 The part about the radio collar
632 ...the tracking of the snow leopard's route
635 Information on how the leopards were tracked
643 The section about the snow leopard and the tracking radio collar
650 ...tracking collar
651 Informational display & leopard radio collar
656 The radio tracking
661 The part radio tracking of snow leopards
658 The radio collar put around leopard
710 Interested in neck chocker
716 Explanation regarding the tracking collar
717 The collar & info showing how the snow leopard is tracked
719 The explanation of ... the snow leopard tracking
721 The second table which told of the tracked snow leopard
730 The table with the tracking system for snow leopards
739 The collering of the snow leopard
740 The section regarding tracking
745 Map board [of snow leopards]

Appendix U

THE RADIO TRACKING DISPLAY (32)

750 The collar used by Dr. to track leopard
751 The tracking of the snow leopard
753 The collar
763 The collar for radio tracking
764 Radio tracking collar; animal movement
p601 Snow leopard tracking collar
p605 The collar gave you a better idea of the true size of the animal and...
p607 The collar that helps you find the snow leopard
p702 I liked the radio collar and map
p703 The information about how they tracked the leopards
p707 Display of an actual collar as used

INFORMATION IN GENERAL (18)

613 The information
615 Information
634 ...& gener info about leopards
638 I liked reading the information regarding the issues of the snow leopard
647 the signs
652 The information display
655 printed material
711 ...information signs
713 ...one of the readings
722 Reading material
748 Information tablets
755 Printed information
756 Knowledge
761 Info on snow leopards
733 Very interesting lot to learn from
p602 Information
p603 ...the information
p704 The descriptive information

THE NATURAL SURROUNDINGS (8)

610 View
636 The greenery, plants
711 Wildlife setting,...
713 I liked the foliage - ...
724 The best part is where the Little Creek is
754 Pond - stream area
p603 The forest and...
p606 The separate alcove setting: quiet, introspective

Appendix U

THE DIARY EXCERPTS (7)
623 Cat 964 hunting diary of a scientist
645 The log (diary)
649 The informative aspects of the diary's excerpts
712 Diary entries
715 Diary entries - type of detail - showed excitement
719 ...the quotes from the snow leopard tracking
728 I liked the diary of the researcher who studied the snow leopards

NOTHING (5)
620 Nothing much
641 Nothing
726 None
736 None
737 Was not too interested. [I asked for an elaboration: No introduction into display.]

THE SIGN WITH THE BUDDHIST QUOTE (3)
632 The parts that describe spiritual or religious beliefs of Buddhism;...
729 The plaque on Buddhism
p701 I liked learning a bit about Buddhism and how it pertained to wildlife

THE WORLD MAP (1)
630 World map

MISCELLANEOUS REPLY (10)
608 Information about how the leopards live and are raised.
629 I like best the leopard
637 ...also where they showed the continent where they live
627 Conservation concerns
714 The animals themselves
727 The layout was pleasing and easy to follow
734 Watching snow leopards
743 The tactile exhibit
p604 Interesting information on conservation efforts
p708 The explanation to the leopard

Appendix V:
HIMALAYAN HIGHLANDS OPEN-ENDED SURVEY QUESTION #2A - VERBATIM RESPONSES CONTENT-ANALYZED

Did you learn anything from the display? YES NO

If YES, what did you learn?

<u>LEARNED FROM THE ROTATING PANELS</u> (45)

612 There are different reasons & viewpoints for looking at a particular situation & ...
616 That people see life differently and the means of survival are differentiated among people
618 Different viewpoints on how different people see the problem of extinction on snow leopards...
623 Hard to protect snow leopards - many social & political issues to complicate simple idea of "protection"
626 The culture of the people clashing with the endangered snow leopard
630 Conflicting interests
632 ...conflicting opinions of WCI interests & those of others...
634 The various reasons people justify killing the leopards- or not...
637 I learned that it has to do with survival for some people and saving the animal for other
638 The various different reasons why people feel the way they do
639 Each person's reaction was reasonable
642 That the snow leopard are rare in the wild and were/are sought after by hunters
644 That the animal & human issue is more complicated than it seems and that it is important to deal with it to insure survival of both
646 There are always two sides to be taken on account. The ones that terminate the lives of the animals are just looking at their own side. The other side must also be ~ ~
650 That the snow leopard is not very liked in their habitat
654 Snow leopards are animals that need protection but must also be protected against
660 The various perspectives of the people involved in defending/ not defending the leopard...
712 It's never easy when you know all sides of a question
716 I pretty much was not aware of the danger it can cause some people depending on their lifestyle. But still believe that the leopard should not be ~ ~
717 Interesting to learn various sides/opinions people have regarding pros & cons of snow leopard
719 The local problems with trying to save these animals

Appendix V

<u>LEARNED FROM THE ROTATING PANELS</u> (45)

721 There is a controversy regarding the life style of the snow leopard
724 How people have to defend them selfs from snow leopard, but the also have to learn how to keep them alive for our future
727 That efforts (political) are being made to protect the snow leopard from being hunted
728 ...the section with opinions from conservationists was very interesting
729 The conflict between locals ~and~ the snow leopard population
732 The diff aspects, views; a little too much reading
740 ...The problems leopards have caused so far back in history
741 Killing goats
746 About the people and their situation...
749 There are 2 sides to every question, although I think that wildlife must be preserved
756 The snow leopard is or seems to be in trouble because the laws that protect them don't; example (cop seeing skin)
758 There are 2 sides to this issue
759 Protection of wildlife is not a simple clear-cut situation
760 Snow leopards are a food source. There is controversy about this.
761 Greater understanding of competition of food and habitat between humans and wildlife
764 Why there are reasons to kill versus reason not to kill animals
737 Tibetan farmer's way of life
p601 Govt involvement & WCI in saving leopard from extinction
p602 Different reasoning for killing or saving the snow leopard
p702 ...That human perspectives on value of snow leopards vary
p704 The problems associated with preserving wildlife; Conflicting viewpoints
p706 Others points of view;...
p707 Schaller's comments stressing the importance of interaction - the reminder that saving habitat & wildlife involves the people of the area (socio-economic)...
p708 The importance of protection from the police's standpoint - must not kill them

<u>LEARNED FROM THE TRACKING DISPLAY</u> (33)

611 Snow leopards wear trackers
612 ...tracking of snow leopards
613 About the collar to track the animal

Appendix V

<u>LEARNED FROM THE TRACKING DISPLAY</u> (33)

614 How leopards are tracked down
618 ...To track an animal with a radio transmitter
624 I didn't know you could get that close to use a collar
632 ...tracking of snow leopards...
634 ...tracking methods by conservationists
635 That the leopards are hard to find
640 About the radio collars used in tracking animals
641 What a tracking collar looks like
645 How they track endangered species
649 Snow leopards are rare and difficult to track
656 How the animals are being tracked
660 ...The extensive routes of the snow leopard
710 How they catch them after 6 wks & food
714 ...I was surprised at the area/range covered
715 The difficulty of observing - & the joy of such a lifestyle; also - many details
723 How the they are tracked
725 How the animals are tracked
728 Gained insight on snow leopards, research...
730 We learned the long process it takes for the snow leopard to be tracked
735 The distance a snow leopard travels
739 That it took a long time to collor the snow leopard
740 The tracking section...
745 How snow leopards are tracked
750 Dr. track 5 leopards for several years to learn about their habits
751 I learned how they track snow leopard to discover its habits
753 The research of the leopards
754 Amount of time needed to track animals & research - amount of persistence - types of technology needed
p606 Tracking collar & charts
p702 That snow leopards travel in a relatively small area;...
p706 ...tracking systems

<u>LEARNED FROM THE WCI WORLD MAP DISPLAY</u> (3)

632 WCI interests & goals;...
746 ...and about Wildlife Conservation International
p702 ...That WCI has lots of projects;...

<u>LEARNED FROM THE SIGN WITH THE BUDDHIST QUOTE</u> (1)

p701 I liked learning a bit about Buddhism and how it pertained to wildlife

Appendix V

<u>MISCELLANEOUS LEARNED INFORMATION - REFERENT DISPLAY IS AMBIGUOUS</u> (34)

610 Animals and their endangered status
617 About back ground of specimens
619 I learned that we need to take responsibility of how we treat our wildlife. Also we need to create stricter laws in order to help preserve our endangered species.
620 I learn that I have to help preserve wildlife
621 It is many people that care about that spice to keep this animal for future [native Polish speaker]
629 All the things, because I use to read about
632 ...the physical ~dimensions~ of leopards
636 That lots of people will kill the snow leopard for coats
643 I learned what measures are being taken to save that certain species
651 More about snow leopards and their extinction
652 That the animals need help from humans
655 WCI info about conservation
657 Snow leopards are endangered and will eventually cease to exist in the wild
661 The amount out time a study
622 A lot of interesting things
658 Animal movements, habits, daily routine
709 The area of the snow leopard in the Himalayas
711 Habitat of the animal, history
713 From what I read, a little about snow leopard & its environment
718 People are putting forth great effort to conserve wildlife
722 Snow leopards are in danger
731 That they are endangered
734 Information about snow leopards
744 The reason of the interest people for conservation of this species
746 ...and about the leopards...
748 About snow leopards & how they live
755 Endangered species
726 About the research
p604 The amount of time and resources spent on establishing wildlife preservation parks
p605 History of snow leopards
p607 Where some of the animals come from and how there trying to stop the wildlife hunting
p703 I learned about the activities of the leopard
p705 Snow leopards are from the Himalayas
p707 ...The dedication & perseverance of the study members

Appendix W:
HIMALAYAN HIGHLANDS OPEN-ENDED SURVEY QUESTION #2B - VERBATIM RESPONSES CONTENT-ANALYZED

If NO, was there a reason that you didn't learn anything?

<u>VISITOR WAS NOT INTERESTED</u> (8)
609 Didn't get my attention to much to read; zoo is for observation.
611 It was boring
615 Not interested
641 Boring
647 I didn't take the time to look at just signs, you should have some kind of animals to attract people's attention
648 ...I prefer watching at a zoo not reading
763 More interested in animals
736 Not interested

<u>VISITOR ALREADY KNEW THE INFORMATION</u> (5)
608 Knew alot
653 I already knew about the display
714 Most of it I knew...
738 I'm a biology major at college and I took a course in ecology where we covered the environment & it's animals
743 I was aware of the Chinese gov't's views and those of the farmers from reading journals such as National Geographic and viewing programs on PBS and The Discovery Channel

<u>VISITOR WAS WITH A CHILD</u> (2)
648 The baby was distracting - ...
760 Could have learned more - child was anxious to leave.

<u>MISCELLANEOUS REASON FOR NOT LEARNING</u> (2)
627 I have not seen it yet
p603 Not the spur of the moment learner

Appendix X:
HIMALAYAN HIGHLANDS THREE KNOWLEDGE ACQUISITION QUESTIONS - VERBATIM RESPONSES CONTENT-ANALYZED

1. Snow leopards are rarely seen. What device has allowed these animals to be studied in the wild?

<u>COLLAR/RADIO COLLAR/TRACKING COLLAR/</u>
<u>(OR "NECK" MENTIONED)</u> (62)

609 tracking collar
610 collar
612 tracking collar
613 a collar
616 radio collar around the leopards neck
619 the tracking collar
620 collar
621 that is the radio goes around the neck [native Polish speaker]
624 radio collar
626 radio collar
632 tracking collar
634 collar
636 tracking collar
639 collar
640 radio collars which track their movements
641 tracking collar
643 radio tracking devices (around their necks)
645 The collar with the tracking device
649 electronic tracking collar
651 radio collar
654 radio collars
655 electronic collar
660 the tracking collar
661 radio collars
658 radio collar
709 the tracking collar
711 collar
712 radio collars
714 radio/radar collar
715 monitoring collars
716 tracking collars
717 tracking collar
718 a radio activated collar
721 the tracking collar
723 tracking collar
730 tracking collar
734 neck collar
735 radio collar
740 tracking collar
743 radio collars

Appendix X

<u>COLLAR/RADIO COLLAR/TRACKING COLLAR/</u>
<u>(OR "NECK" MENTIONED)</u> (62)
745 tracking collar
748 tracking collar
749 radio collar
750 collar
751 the tracking collar
753 the collar
758 the collar thing
760 radio collar
761 tracking collar
763 radio tracking collars
p601 tracking collar
p602 radio collars
p603 neck device
p604 the tracking device collar
p606 tracking collars
p701 tracking collar
p702 radio collar
p703 the #4 collar
p704 collars
p705 collar tracker
p706 tracking collars
p707 radio collaring

<u>RADIO FREQUENCY/RADAR TRACKING/RADIO TRANSMITTER</u> (7)
618 radio transmitter
623 tracking by radio, dedicated scientists who care
635 radio tracking
656 radio transmitters
731 radio frequency
759 radar tracking
764 radio tracking

<u>TRACKING DEVICE</u> (18) (all answers are "tracking device" except for those noted)
608
611 tracker device
615
638
642
644
647
657
659
719
729 tracking device/long-distance tf lens

Appendix X

<u>TRACKING DEVICE</u> (18) (all answers are "tracking device" except for those noted)

738
741 tracking
746
754
755
p605
p607 tracking advice

<u>INCORRECT ANSWER TO QUESTION #1</u> (1)

732 snow leopard device

2. What was the name of the conservation organization mentioned on the signs?

<u>CORRECT TITLE (WILDLIFE CONSERVATION INTERNATIONAL)</u> (2)

746 Wildlife Conservation International
p707 Wildlife Conservation Internation

<u>CORRECT INITIALS (WCI)</u> (19) (all answers are "WCI" except for those noted)

632
648
653
654
655
709 WCI world conservation international
712 I thought there were two WCI &
723
728
729
735 WCI ?
743 Wildlife Conservation Institute (WCI)
760
764 WCI World Conservation International
p601
p606
p701
p702
p706

Appendix X

PARTIALLY CORRECT WORDS OR REVERSED INITIALS (5)
640 Wildlife Conservation
716 WIC
719 Wildlife Conservation Institute
738 CWI
754 World Conservation International

INCORRECT ANSWER TO QUESTION #2 (17)
618 World Wildlife...?
624 Wildlife
634 United Wildlife ~Fed~
636 CIV
660 WWZO
658 Wildlife Conservatory Organization
710 Swartz? 3rd one
717 Jefferson? Jackson?
718 Something with an N in it
721 NYZ?
741 Wildlife
744 "Snow Leopard Conservation"
750 New York Conservation
751 Wildlife Federation
755 Wildlife ?
761 Wildlife
p607 Buddhist writings

3. What general message did you get from the rotating panels?

THE MAIN POINT OF THE ROTATING PANEL DISPLAY (42): There are different sides/views of the snow leopard conservation issue

612 Different opinions about the snow leopards living with humans
618 Different viewpoints
626 The need for animals and humans to co-exist
634 Peoples conflicting concerns
635 There is conflict between the local people protecting their livestock and the ability to preserve the snow leopard
642 2 sides to having snow leopards around
644 There are two sides to the snow leopard issue
649 2 sides to every story - the position of the inhabitants & the position of the nature conservationists & animal rights people

Appendix X

THE MAIN POINT OF THE ROTATING PANEL DISPLAY (42)

650 There are conflicting feeling about killing the snow leopard

651 Both sides of the snow leopards fight with extinction. Both points are valid

654 There are two sides that must be taken into consideration very carefully

660 That there are valid and logical reasons on both sides, even though my sympathies are with the leopard

709 The feelings of conservationalist/people of the region

712 Solutions are difficult but possible if creative solutions from innovative directions

713 That there are various ways that people view the preservation of animals and their needs

714 Respect and take account of all sides of a ~com~

715 Many perspectives - each valid

717 The snow leopard is a controversial subject with opposing sides between local natives & conservationists

718 People's personal concern & interests as related to conservation

719 Positive message re: the attempt to save these animals, with limited commentary about the problems that they face

721 There are two sides regarding the treatment & conservation of the snow leopard

723 Different points of view are based on different needs of the individual

725 How it really depends upon which side of the fence you're on. When stated, both sides can be appreciated

728 Conservation of the snow leopard is a difficult task as researchers/conservationists face many opponents

729 Two sides to each conflict

730 There are different reasons, all viable, for people to want to protect the animal or kill it

731 Different opinions by different people

732 The diff views of diff people in various situations

735 A feel for the different people worldwide

743 The views of the wildlife preservation community and those of the Chinese police/govt and the farmers

749 Some people are for wildlife protection no matter what costs. Others feel that their livelihood threatened by conservation

750 Different pts of view

753 How leopards affect different people. Some like them and some don't. Some want them killed.

759 One man's gold is another's poison - [on previous page: The opposing viewpoints of the need to kill the snow leopard vs save him. Protection of wildlife is not a simple clear-cut situation.]

760 There are two sides to this story

Appendix X

THE MAIN POINT OF THE ROTATING PANEL DISPLAY (42)

764 Possible extinction. Reason to kill versus reason not to kill.

p604 Everyone has different needs and ideas

p605 That their fate is far from certain, and different groups see the animals differently

p606 Conflict between real life and conservationists

p702 There are various views of value of protecting snow leopards

p705 That people have varying views of the dangers and need for snow leopards

p707 See question #2 previous page [Schaller's comments stressing the importance of interaction - The reminder that saving habitat & wildlife involves the people of the area (socio-economic). The dedication & perseverance of the study members.]

THE MAIN POINT GIVEN ELSEWHERE ON THE SURVEY (13)

621 That is good that some people want to save an animals for future - [on previous page: it is fight between the conservation and common people] [native Polish speaker]

623 Prayer helps - [on previous page: Hard to protect snow leopards - many social & political issues to complicate simple idea of "protection"]

632 Respect & accommodation of ecological interests compatible with Buddhism - [on previous page: conflicting opinions of WCI interests & those of others]

637 That the people living of hunting animals didn't care if they did out. The rest liked them saved, because the rase is so rare - [on previous page: it has to do with survival for some people and saving the animal for other]

638 I did not turn them. I didn't realize they could be turned. - [on previous page: The various different reasons why people feel the way they do]

639 [blank -she did not know that they flipped] [on previous page: The different points of view; Each person's reaction was reasonable]

646 To put yourself on a snow leopard shoes and see how it's like -[on previous page: There are always two sides to be taken on account]

716 It is a awareness to the people on how we should keep the snow leopard alive - [on previous page: I pretty much was not aware of the danger it can cause some people depending of their lifestyle. But still believe that the leopard should not be - -]

724 [blank] [on previous page: How people have to defend them selfs from snow leopard, but the also have to learn how to keep them alive for our future]

Appendix X

<u>THE MAIN POINT GIVEN ELSEWHERE ON THE SURVEY</u> (13)

758 [blank] [on previous page: There are 2 sides to this issue]
p602 [blank] [on previous page: Different reasoning for killing or saving the snow leopard]
p704 Need for more funds to support this project - [on previous page: The problems associated with preserving wildlife; Conflicting viewpoints]
p706 How the snow leopards affect people's lives - [on previous page: The display depicting the people and their opinions. Others points of view]

<u>A CORRECT SPECIFIC IDEA FROM THE ROTATING PANEL DISPLAY, BUT NOT THE MAIN POINT</u> (20)

610 Snow leopards are endangered
615 Animals are going to be extinct without preservation
616 That the means of survival are different from the different people
619 The snow leopards are endangered
624 That a lot of people kill the leopards because of them killing the other animals
636 Reasons why people had to kill the leopard
647 Different people that dealt with them
655 Snow leopards are difficult to locate and track, they must be protected from man or they will become extinct
727 That political leaders are trying to prevent the demise of the snow leopards
741 Killing goats
746 What the peoples situation's are
748 The leopards are rare animals & very important to our world to keep for future generations to appreciate
751 The snow leopard needs to be protected to become from being extinct
755 That the snow leopards are endangered
756 In trouble - [on previous page: The snow leopard is or seems to be in trouble because the laws that protect them don't; example (cop seeing skin)]
761 How we all are competing for basic needs of life
p601 Various govt involvement in saving animals
p603 They kill them
p607 Save the wildlife (There are people that do care)
p701 Different people's commitment to keeping snow leopards safe

Appendix X

INCORRECT ANSWER TO QUESTION #3 (12)

645 Get involved in wildlife conservation
657 Differences will not be resolved
627 Conservation
658 These want to see leopard protected but also will kill if threatened
710 There all involved & know a lot
738 That people go to different extents to help animals but all do try to help in their own way
740 That the snow leopard has been a problem through several ~centuries~
744 Look for more information
754 Time consuming process
763 Historians had different opinions on wildlife preservation
733 How the snow leopards live
p703 How they were ~tracking~ the leopards

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