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ABSTRACT

In this study, data were collected on 15 visitor groups for the duration of their stay, and on 1556 visitor groups at 18 exhibits at the Singapore Zoo. Mean time at the zoo was 155 minutes; the distribution of the time spent among four activities was analyzed by ethnicity and group size. The actual route followed was traced on zoo maps and group location noted every 10 minutes, leading to a prediction of the route followed by a typical visitor. The mean time viewing an exhibit was 62.8 seconds but varied considerably among exhibits. Data were also analyzed by time of day, ethnicity, group size, species observed, and activity level of the animals. Visitor behavior patterns were also analyzed based on label length and difficulty, and popularity of the species. Taken together, the data provide a general understanding of how recreational visitors behave in zoos with respect to several variables of interest to zoo professionals. (Author/CW)

VISITOR BEHAVIOR AT SINGAPORE ZOO

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ABSTRACT

Data was collected on 15 visitor groups for the duration of their stay, and on 1556 visitor groups (56% Chinese, 16% European, 7% Indian, 13% Malay and 8% mixed or unidentified) at 18 exhibits at Singapore Zoo. Mean time at the zoo was 155 minutes; the distribution of time spent among four activities was analyzed by ethnicity and group size. The actual route followed was traced on zoo maps and group location noted every 10 minutes, leading to a prediction of the route followed by the typical visitor. The mean time viewing an exhibit was 62.80 seconds but varied considerably among exhibits. The data also was analyzed by time of day, ethnicity, group size, species observed, and activity level of animals. Label reading by one group member varied among exhibits from 30.72% to 2.32%, time spent reading was equally varied. Data was analyzed for possible patterns based on label length and difficulty, and popularity of the species. Taken together, the data provide a general understanding of how recreational visitors behave in zoos with respect to several variables of interest to zoo professionals.

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INTRODUCTION

Purpose

The major purpose of this study is to determine the tempora and spatial patterns of recreational visitors to Singapore Zoological Gardens. Bernard Harrison, Director of the Singapore Zoo, gave the permission that made the study possible, and many members of his staff took time from their busy schedules to orient me to the zoo, including its education program and special design characteristics. Cheah Kee Han opened his home to a stranger and taught me more about the city than several previous visits.

Singapore Zoological Garden

The Republic of Singapore has three major zoological institutions: Van Kleef Aquarium (approximately 315 species), Jurong Bird Park (approximately 260 species) and Singapore Zoo (approximately 150 species). Singapore Zoo was selected for this study for two reasons. First, it is a major zoo comparable in size to other zoos participating in this study. Second, the unusual demographics of Singapore, with four easily distinguished ethnic groups, makes it possible to add an intercultural dimension to the study.

Singapore Zoo is about 40 minutes north of Singapore City by bus. It occupies 28 hectares (69.19 acres) that looks much larger because it is bounded by an even larger lagoon. The terrain is relatively flat, the flora tropical, and the paths meandering. The collection includes about 90 species of mammals, 30 of birds, and 30 of reptiles. Animals are grouped more nearly by taxa than geography, and are well-spaced throughout the zoo in enclosures of considerable diversity, often without bars, and incorporating a wide variety of effective and often innovative design subtleties.

A visitor tram is available and takes 20-25 minutes for a general tour of the zoo. There are three eating areas (and a fourth for school visitors), a large souvenir shop near the entrance, and two smaller ones near the main dining area and the ampitheater. Attendance is about 750,000 per year.

A special characteristic of the zoo affecting visitor studies is the emphasis on entertainment. Shows, about 25 minutes long, one starring elephants and sealions and one starring primates and snakes, each run twice a day. The facility is a large outdoor ampitheater with a see-through aquarium in front of the stage. In addition to the shows, visitors are given the opportunity at selected times to take photographs with snakes and primates, and, most famous of all, visitors can "have breakfast (and take their photograph) with an orangutan."

Assumptions

The two major assumptions of this study are that time spent at a zoo is positively correlated with learning and that no single set of educational goals or outcomes should be specified for all recreational visitors.

The first assumption originates in the findings of the International Study of [Mathematics] Educational Achievement (1969) that student test performance is positively correlated with the relative emphasis given to specific topics as measured by class and home study time. More recently David Berliner has developed a theoretical model that explains this finding in terms of four kinds of time and appears applicable to efforts at increasing the educational impact of zoos on recreational visitors.

Berliner's "allotted time" is interpreted in the zoo context as the total time a group spends at the zoo. The obvious goal of increasing it could be accomplished by more frequent visits, longer visits, or both. Coe (1985) suggests that this requires understanding and fulfilling visitor needs (not merely imposing the conservation ethic zoos seem determined to inculcate), and providing novel experiences. Falk (1982) found that total visit costs (entry, souvenir, food, and transportation) and easy parking are major factors in visit frequency and duration. Ideas now common to accomplish this goal include an "animal of the month," advertising zoos as an inexpensive family outing, publicizing baby animals, public feeding of animals, changing labels periodically (e.g., seasonally), and special events tied to local or national holidays or the heritage of ethnic groups represented in the community. Similarly, we are seeing more and more exhibits that, as suggested by Cheek and Brennan (1976) and others, with much broader and complex themes than the usual emphasis on geography and taxonomy.

Berliner's "related time" is interpreted in the zoo setting as the time visitors actually are learning about animals or related topics. Ideas to increase it--and to demonstrate it is not limited to exhibits, include educationally relevant souvenirs, improving zoo guides and maps, and printing food containers, placemats and the like with animal quizes and games, zoo news, animal behavior to watch for at exhibits, information on exhibit design, zoo staff, and joining the zoo.

Berliner's "engaged time" is interpreted in the zoo setting as the time visitors spent at exhibits. Coe (1985) suggests this requires emotional involvement, while Borhegyi (1964) suggests planned variation. Bitgood (1985) Visitor density affects time at exhibits (Bitgood, 1985) as do interactive labels (Hoppes, 1986), recorded sounds, touch tables, keeper lectures, animal rides and animal shows. Followup work to the research of Falk (1982) and Wolfe and Tymitz (1978) offers a fertile approach to increasing engaged time.

Finally, Berliner's "successful time" in the zoo refers to actual educational outcomes. Coe (1985) suggests that people are more disposed to learn from or about animals if they are looking up at them, encounter them by surprise or in a novel setting, are surrounded or outnumbered by the animals, or are close to them. More and more, zoos are designing exhibits to achieve predetermined educational objectives and are helping visitors to understand them, as called for by writers such as Borhegyi (1964) and Cheek and Brennan (1976), and Screven (1976, 1979). A related problem is increasing label

reading, a problem addressed by Bacon and Hallett (1981) and Rand (1986) among many others.

The second assumption reflects the variety of zoo visitor, from child to adult, from illiterate to Ph.D., from animal liberationist to medical researcher, from humaniac to trophy hunter. This situation is vastly different from the typical school classroom, in which students are grouped together at least roughly by educational need, ability, and level. It is the major reason care must be taken in setting educational objectives in designing exhibits. One clever approach to this problem is Edinburgh Zoo's experiment with dual exhibit labels (Ollason, 1981). One, placed low for children, includes questions to ask parents. The other, placed high, makes sure the parents can answer the questions, promoting family interaction about the exhibits! The literature includes a few other suggestions addressing the same problem--but relatively few given its importance.

METHODS

Data was collected by observation. The approach avoids the many problems whenever research requires translation. so was particularly appropriate to visitor research in Singapore! Further, the approach minimizes the tendency people have to change their behavior--or their answers to questions--when they become the subject of research. The rationale for use of nonreactive measures has been explained elsewhere (Churchman, 1984). Observation of people uninformed that they are the subject of study is considered ethical so long as it is confined to public behavior in public places.

One type of observation was conducted at 18 specific exhibits. Visitors were timed for three one-hour time periods at each (1000-1100, 1200-1300, and 1400-1500). Timing began when a visitor crossed a predetermined line, and ended when the first member of the group left an exhibit--what accountants might term FIFO. The ethnicity and size of each group, the direction from which it approached the exhibit, whether (still, video, or movie) photographs were taken, any abusive behavior, and whether and for how long exhibit labels were read also were noted. Exhibit labels were copied out for later analysis of reading levels. These data were recorded weekdays in late November and early December 1986 on a form designed for the purpose.

The other type of observation consisted of following 15 randomly selected visitor groups divided among the four ethnic groups very roughly according to their proportion of the Singapore population. The route they followed was marked on a zoo map, and their location noted every 10 minutes. Time spent eating, shopping, and in other activities also were noted. These data were collected during weekends in late November and early December 1986.

The methods complement one another. The first concentrates on behavior at exhibits, the second at behavior between exhibits. Together, they provide a general understanding of how recreational visitors behave in zoos on the variables of greatest interest to zoo professionals.

Definition of Terms

Abusive behavior includes feeding, throwing objects into enclosures, teasing, and verbal abuse. Typical teasing behavior includes offering to but not actually feeding animals or tapping on enclosure glass. Verbal abuse

consists of any derogatory remark directed at an animal while viewing it.

Exhibit observation consists of information on the time spent at specific exhibits by various size visitor groups, whether they engage in any abusive behavior, or whether they photograph the exhibit.

Nonreactive measures are methods of collecting data which do not interfere with the normal behavior of subjects.

Recreational visitors are members of the public spending a portion of the day at the zoo.

Spatial patterns are the actual routes followed by visitors while in the zoo.

Temporal patterns consists of total time spent at the zoo and the way it is divided among (1) walking among and viewing exhibits, (2) eating, (3) shopping, and (4) other activities.

RESULTS

Table 1 and Figure 1 summarize the observations on visitors followed for the duration of their visits. An obvious point is the rarity with which Chinese families enter the souvenir areas. Equally obvious is the high proportion of time spent by Chinese visitors in "other" activities. Unfortunately, this was not obvious enough at the time data was being collected to have taken any special note of just how (other than tram riding) this time was spent. Overall, the 155 minute average stay is about 35 minutes longer than the average Falk (1982) found for museum visitors and almost identical to that found at Melbourne (Churchman, 1987)

Shows are included under walking and exhibit time, and tram riding under "other" time. In some cases (e.g., the 5th Chinese and 2nd Indian group), show visitors arrived late or left early. Another factor affecting behavior at this season in Singapore was rain (brief but common), which led the 2nd Malay family to leave the primate show for shelter for 8 minutes. The 5th Chinese family fled to the shelter of the restaurant during a hard rain, so are reported as spending 25 minutes eating.

Figure 1 presents the route most likely to be followed by a visitor. It should be interpreted as the choice a group is most likely to make at an intersection, if it has made the most common choice at the previous intersection. More specifically, 60% of all visitors are likely to turn left at the otter exhibit as shown. Seventy-five percent of those that do are likely to turn toward the ampitheater after passing the kangaroo exhibit, and 95% of them are likely to stay for the show. Afterwards, 70% are likely to head past the orangutans, small mammal house and reptile house, and 70% of those who exit the reptile house are likely to head toward the exit via the longer route past the leopards. Although not shown, the 40% who turned right rather than left at the outset were most likely to follow the route shown, but in reverse. Thus, the route shown dominates, regardless of the direction chosen by visitors.

It also is possible to make predictions of where visitors will be after varying amounts of time at the zoo. Ignoring time spent watching shows, a

group following the route shown in Figure 1 is most likely to be at or near the kangaroo exhibit after 30 minutes, at or near the orangutan exhibit after an hour, at or near the reptile house after 90 minutes, and approaching the exit after 120 minutes.

Shows had a profound affect on visitor routes. Any observer could not help but notice that visitors within hearing of the ampitheater stream toward it as they heard the beginning of a show. The number of visitors ebbs and flows in concert with the shows. Unfortunately, the sample of visitors followed is insufficient to draw inferences about the impact of the shows on their routes afterwards, except to hypothesize a general flow toward if not always actually to the nearby restaurant.

Tables 2 and 6 present data on visitors at exhibits by race. The hypothesis that there is a difference among visitors in time spent at exhibits is tested, and rejected, by the analysis of variance presented in Table 3.

Table 4 presents data on time spent by visitors at the 18 exhibits at three different times of day, and overall. The hypothesis that there is a significant difference among visitors in the amount of time spent depending on the time at which they reach the exhibit is tested, and validated, by the analysis of variance presented in Table 3. Table 7 presents data on the impact of animal activity, and Table 8 presents data on selected visitor activities at these same exhibits.

Table 3 also presents the analysis of the hypothesis that both the time of day and the direction from which visitors approach an exhibit (assumed to be indicative of the time spent in the zoo before reaching the exhibit). The analysis indicates that the factors do not interact with one another, and that the direction is insignificant. But, the analysis again finds that the time of day is a significant factor in how long visitors spend at exhibits.

Table 5 presents data on the exhibit labels and the extent to which they were read. The grade level at which the signs are written was estimated using the Flesch and Gunning-Fog systems. Ratings are consistent with the exception of the label for the Malayan sun bear. The only significant correlation among these data is -.67 ($p < .01$), meaning that time spent reading signs increases as the Flesch grade level declines.

The Flesch index is based on the relationship between words per sentence and syllables per sentence. This in turn suggests that label reading can be increased by short sentences. Flesch also suggests that interest--as opposed to mere ease--improves with the proportion of "personal" words. He defines these as all first, second, and third person pronouns except it, its, itself, they, them, their, theirs, and themselves; all words having natural feminine or masculine gender (e.g., actress and iceman but not teacher or doctor), and the two words "people" and "folks."

An important question is not only whether labels are read, but how much of a label is read. Testing visitors for knowledge gained, or even asking them how much of a label they really read, are unlikely to yield valid estimates. It is a difficult but interesting challenge for the researcher, probably best approached by considering the indicated reading rate if labels had been read completely. Table 5 is arranged according to this criterion.

CONCLUSION

Beyond the specific results obtained at Singapore, the methods reported provide researchers with useful tools for studying visitor behavior. They are nonreactive, so overcome the tendencies of visitors responding to interviews or questionnaires to report desired rather than actual behavior. Direct measurement is much more precise and reliable than asking departing visitors about their behavior. There are no instruments requiring translation, they are particularly suitable in multicultural situations. Even in the U.S., where Hispanics are over-represented among zoo visitors relative to their proportion of the population, this is a useful characteristic. Data collection requires little training, so volunteers can be used to collect data. Even the apparent exception--tracking visitors--is not that difficult, although it does take a while to learn the techniques.

Finally, if we ever are to achieve general understanding of visitor behavior, we must begin to provide a more general theory relating the variables we measure to one another. Such theories both suggest what to measure and a means for interpreting data. Social scientists seem fond of elaborate theories involving large numbers of concepts both obscure and difficult to measure. But, historically, the most powerful theories seem to have been the simplest--a principle articulated by William of Ockham in the 14th. century. For these two reasons, we chose Berliner's model as a first try at providing a theoretical framework for visitor studies.

Against these strengths are some weaknesses. It is difficult to time visitors at exhibits with long perimeters. With the exception of the orangutan and polar bear exhibits, this study simply avoided the problem. As these two exhibits also have very high averages for time spent at exhibits, perimeter length provides an alternative hypothesis to activity level and attractiveness of the species themselves for their holding power that cannot be tested with the data we have available. Future studies should include this factor in their design.

Following visitors for their entire visit is labor intensive, especially if trackers are switched periodically to reduce the likelihood of detection. This study--only one tracker was available to collect the data--suffers all the usual problems of too small a sample.

The methods reported could have been improved in two ways. First, it would have been useful to distinguish first-time, occasional, and frequent visitors, and to track each type separately. This was impractical at Singapore. In developing the method at Los Angeles, we tracked only ticket buyers (easily distinguished from a distance as they passed through the turnstyles), on the assumption that members were frequent visitors. The study could have been improved by approaching them with a questionnaire at the end of their visit (perhaps but not necessarily informing them they had been followed) to determine this and other information.

Second, the estimate of total time spent at the zoo is based on a relatively small--and varied--sample. A relatively simple way to validate it which embarrassingly did not come to mind till just after leaving Singapore would have been to time cars into and out of the parking lot! It is not perfect--many visitors arrive by bus--but if the averages were similar, it would significantly improve our own confidence in the data reported.

Beyond simply replicating the methods with the improvements suggested, even greater improvement would follow if the nonreactive methods reported were combined with interviews, questionnaires, and perhaps even tests. The strengths and weaknesses of each approach are almost perfectly opposed, making possible truly comprehensive studies that would significantly improve our understanding of zoo and aquarium visitors.

Despite these suggestions, the nonreactive methods alone do provide a good general understanding of visitor behavior at Singapore Zoo on dimensions of interest to zoo administrators, educators and planners. Data on more exhibits, and tracking of more visitors, would add precision, increase confidence, and make detection of patterns easier. But, these are quantitative, not qualitative, improvements. At a cost of less than 100 hours data collection, the study provide a good idea of what parts of the zoo are and are not well-visited, how visitors use their time while in the zoo, and whether or not they read signs.

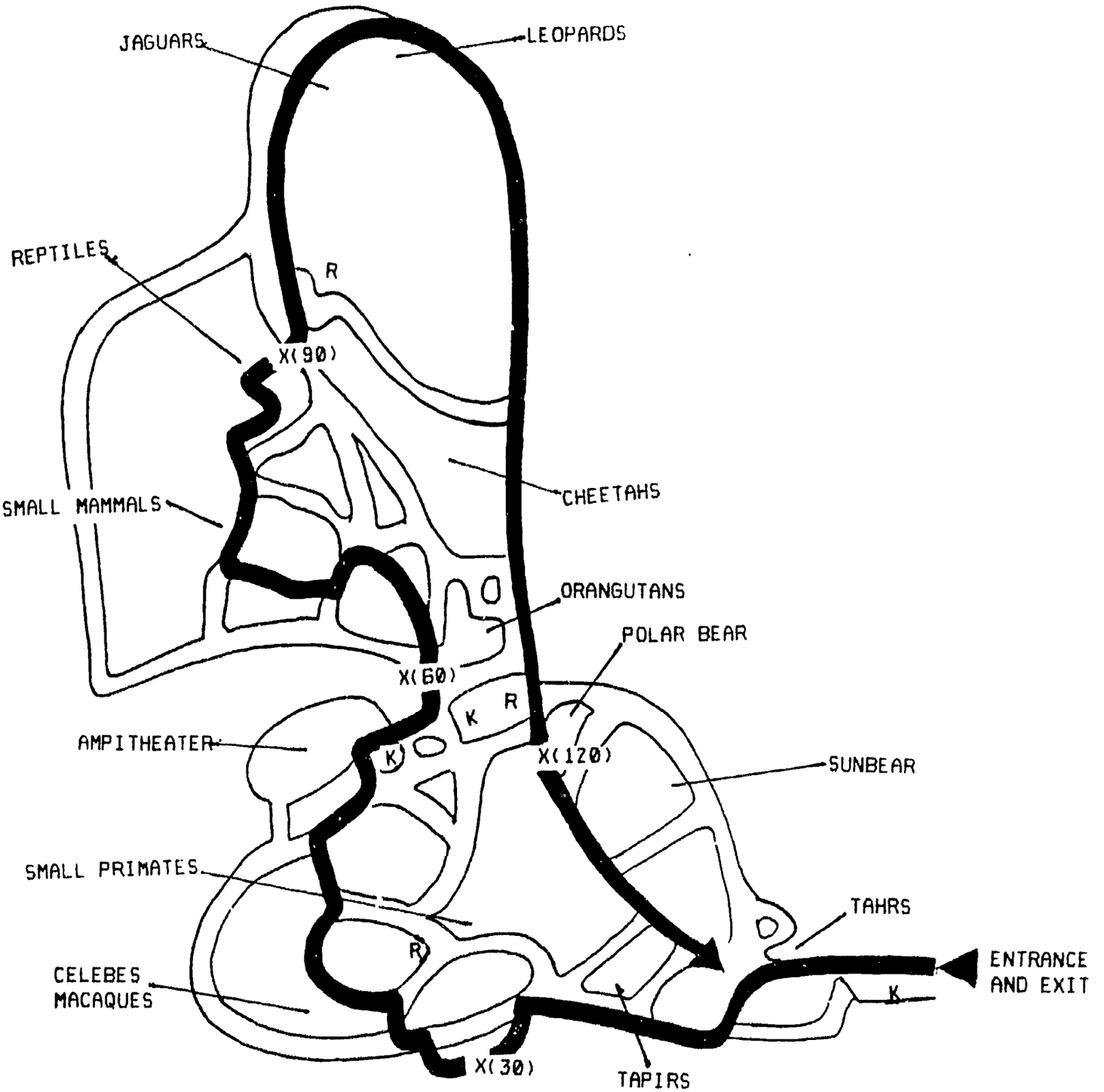

Figure 1: Predicted visitor route through zoo and location of exhibits observed

KEY

K = Location of souvenir kiosk
R = Location of restaurant or food kiosk
X(#) = Predicted location of visitor # minutes after entering zoo

Small mammals: Bats, meerkats, squirrel monkeys
Small primates: Marmosets, siamangs, pigtail macaques
Reptiles: King cobra, albino cobra, Komodo dragon

Ethnicity	Adults/ Children	Walking & Exhibits	Eating	Shopping	Other	Total
Chinese	6/3	149 *	13	0	30 #	192
Chinese	2/1	138 *+	23	0	56 #	217
Chinese	3/3	97	0	0	97	97
Chinese	2/2	80 +	4	0	35	119
Chinese	2/2	89 +	25	0	27	141
Chinese	1/3	143 *+	30	0	61	234
Chinese	1/4	81 *+	15	6	64	166
Chinese	3/4	87	0	0	0	87
Chinese	2/3	109 *+	0	2	52	163
European	4/3	80	12	0	37 #	129
European	2/3	68 +	15	7	21	111
Indian	2/4	192 *+	31	3	70	296
Indian	3/1	98 +	11	5	17	131
Malayan	1/4	55 *	0	1	26	82
Malayan	2/2	121 +	18	0	30	169
MEANS	2.4/2.6	105.80	13.13	1.60	41.53	155.60

Time Allocation by Visitor Groups Among Selected Activities
Table 1

* = Elephant & sea lion show
+ = Primate & snake show
# = Tram ride (European group wait 12 minutes on tram before it left)

	Size of Party					Duration of Visit		
	Percent	Groups	People	Mean	SD	N	Mean	SD
Chinese	56.32	869	3181	3.66	1.92	869	61.21	75.08
European	16.47	254	615	2.42	1.26	254	73.88	95.72
Indian	6.93	107	360	3.36	2.01	107	62.12	76.57
Malay	12.51	193	768	3.98	2.27	193	57.33	79.32
Mixed	7.77	120	430	3.58	2.26	120	59.82	79.63
COMBINED	100.00	1543	5354	3.47	1.97	1543	62.76	79.84

Activities at Exhibits, by Race
Table 2

Source	SS	df	MS	F	Significance
Race	39108.26	3	13036.09	2.04	.106
Error	8989806.82	1410	6375.74		
Total	9028915.08	1413			

Source	SS	df	MS	F	Significance
Hour	60549.94	2	30274.97	4.79	.008
Error	9818657.01	1553	6322.38		
Total	9879207.01	1555			

Source	SS	df	MS	F	Significance
Direction	9394.63	1	9394.64	1.97	.161
Time	45103.44	2	22551.72	4.72	.009
Interaction	22534.12	2	11267.06	2.36	.095
Error	7044970.04	1475	4776.25		
Total	7122002.23	1480			

Analyses of Variance
Table 3

Common Name	1000-1100 N	1000-1100 Mean	1000-1100 SD	1200-1300 N	1200-1300 Mean	1200-1300 SD	1400-1500 N	1400-1500 Mean	1400-1500 SD	Combined N	Combined Mean	Combined SD	Scientific Name
Polar Bear	27	217.33	121.05	38	108.37	100.43	23	141.65	81.79	88	139.37	106.02	Thalarctos maritimus
Orangutan	22	122.95	112.39	26	169.31	177.86	23	218.26	181.85	71	170.80	164.14	Pongo pygmaeus
Celebes Macaque	22	49.59	43.57	40	98.02	117.34	26	66.88	133.21	88	82.62	110.09	Cynopithecus niger
Leopard	21	99.14	113.55	59	63.61	45.04	24	104.25	84.47	104	80.16	74.87	Panthera pardus
Komodo Dragon	5	41.80	40.64	24	42.54	22.72	37	82.49	110.84	66	64.88	86.55	Varanus komodoanus
Fruit Bat	5	60.20	36.79	35	41.65	24.37	24	70.79	52.88	64	54.02	40.26	Pterupus vampyrus
Sun Bear	19	49.16	46.92	27	57.37	41.33	25	46.56	41.22	71	51.37	42.50	Helarctos malyanus
King cobra	11	59.64	39.46	56	59.05	39.94	44	72.54	50.13	111	64.46	44.33	Ophiophagus hannah
Jaguar	13	51.69	31.66	52	51.54	38.53	40	73.72	58.61	105	60.01	47.42	Panthera onca
Pigtail Macaque	7	83.00	42.57	20	42.85	51.02	16	70.81	58.09	43	59.74	57.38	Macaca nemestrina
Tahr	15	83.80	42.57	24	40.17	28.72	15	42.53	16.46	54	52.94	36.07	Hemitragus jemlahicus
Cottontop Marmoset	12	30.25	18.63	46	44.78	65.64	19	48.74	108.62	77	43.49	73.70	Saguinus oedipus
Tapir	40	55.88	40.48	49	29.92	31.18	33	49.33	68.17	122	43.32	47.63	Tapirus indicus
Cheetah	17	42.29	51.12	46	31.61	22.78	25	37.28	32.19	88	35.28	32.45	Acinonyx jubatus
Squirrel Monkey	17	23.00	20.91	65	35.20	33.29	35	29.91	17.51	117	30.74	27.82	Saimiri sciureus
Albino Cobra	15	16.13	9.20	43	27.88	15.22	42	37.81	23.00	100	30.29	19.65	Naja naja naja
Siamang	22	32.82	27.19	38	19.03	24.76	22	38.95	49.11	82	28.07	33.89	Symphalngus syndactylus
Meerkat	20	15.80	13.12	55	24.44	25.23	30	23.77	17.22	105	22.60	21.34	Suricata suricata
COMBINED	310	68.85	82.90	743	48.85	54.48	503	68.70	86.17	1556	62.80	79.71	

Time at Exhibits by Time of Day
Table 4

Common Name	Reading Level: Word Length	Reading Level: Flesch	Reading Level: Gunning Fog	Sign Readers: N	Sign Readers: %	Sign Readers: Mean Time	Reading Rate
Pigtail Macaque	71	11	9.5	1	2.32	15.00	124
Siamang	26	CG	10.7	3	3.66	10.66	146
Jaguar	29	12	9.9	27	25.71	8.74	199
Celebes Macaque	23	CG	14.0	6	6.82	5.83	236
Tahr	25	13-15	12.2	14	25.92	5.93	252
Cheetah	31	11	9.5	13	14.77	6.77	274
King Cobra	79	10	10.1	6	5.40	16.83	281
Tapir	36	10	9.6	32	26.23	7.41	291
Fruit Bat	27	13-15	12.2	5	7.81	5.40	300
Polar Bear	42	13-15	11.6	3	3.41	8.33	302
Why Leopards Black?	123	8	9.0	32	30.77	23.22	317
Albino Cobra	47	10	9.1	10	10.00	8.30	339
Sun Bear	29	16	9.9	14	19.72	5.07	343
Komodo Dragon	81	9	10.0	10	15.15	13.90	349
Leopard	106	10	9.8	9	8.65	13.55	469
Meerkat	70	10	10.0	5	4.76	8.20	511
Cottontop Marmoset	159	11	13.4	7	9.09	17.57	542
Orangutan	30	16	15.0	--		--	
What are Apes?	90	10	11.4	--		--	
Squirrel Monkey	31	13-15	12.1	--		--	

Label Reading at Selected Exhibits
Table 5

Race	Photography	Feeding	Teasing	Verbal Abuse*
Chinese	96 (59.63%	11 (68.75%	13 (59.09%	4 (66.0%
European	40 (24.84	3 (18.75	1 (4.54	0 (0
Indian	9 (5.59	1 (6.25	3 (13.63	1 (16.5
Malay	11 (6.83	0 (0	3 (13.63	1 (16.5
Mixed	5 (3.11	1 (6.25	2 (3.11	0 (0
TOTALS	161 (100.00%	16 (100.00%	22 (100.00%	6 (100.00%

* English only, so an underestimate

Exhibit Activity by Ethnicity
Table 6

Common Name	Asleep/ Inactive			Moderate Activity			Very Active		
	N	Mean	SD	N	Mean	SD	N	Mean	SD
Jaguar	54	68.90	53.57	3	116.33	25.58			
Cheetah	71	32.42	30.50	12	56.75	40.02			
Leopard	79	70.38	62.93	24	113.71	100.61			
Siamang	59	25.22	35.35	12	38.92	35.64	9	36.22	20.27
Pigtail Macaque	12	43.00	60.60	30	65.63	56.57			
Marmoset	19	25.16	21.20	38	35.39	74.80	11	108.00	108.72
Tahr	37	47.78	32.92	12	71.33	39.84			
Tapir	52	27.84	30.64	50	55.56	60.16	4	78.25	63.33
Komodo Dragon	45	69.44	101.58	12	47.75	42.41			
Orangutan	15	123.40	102.47	48	193.71	184.96	3	194.00	88.38
Celebes Macaque	30	70.90	127.89	55	88.65	102.86	3	89.33	35.22
Squirrel Monkey	13	21.15	15.06	103	32.02	28.98			
Polar Bear				67	189.85	101.52	6	273.17	159.47
Sun Bear	40	46.85	45.00	22	59.86	39.12	4	84.75	32.61
Fruit Bat	16	55.31	30.42	9	69.56	59.69			
Meerkat	50	16.5	14.58	43	29.35	27.15			
Cobra	52	63.19	43.18	5	57.20	35.60	2	187.50	2.12
Albino	16	16.19	8.89	73	32.85	20.61			

Duration of Visit by Level of Animal Activity
Table 7

Common Name	Photography		Tease	Objects Thrown	Feed	Verbal
	N	%				
Jaguar	8		1	1		
Cheetah	9					
Leopard	21					
Siamang	5		2		3	
Pigtail Macaque			1	1	4	
Cottontop Marmoset	1					
Tahr	7					
Tapir	9			1		
Komodo Dragon	6					
Celebes Macaque	7		2		5	1
Polar Bear	23					
Sun Bear	10					3
Fruit Bat	4		1			
Meerkat	9		13		4	
King Cobra	3		2			
Albino Cobra	3		11			
Orangutan	20		1			
Squirrel Monkey	11		5		2	
TOTALS	208		39	3	18	4

Visitor Activities at Selected Exhibits
Table 8

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