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Cover Page Footnote
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ADJUSTMENT PROCESS OF AFRICAN ELEPHANTS TO A NOVEL SITUATION

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ABSTRACT: The purpose of this study was to describe the adjustment process of African elephants when separated from companions and introduced into a new enclosure. Two elephants were observed for fourteen sessions in the novel enclosure and for five sessions in their regular exhibit areas. Each session lasted thirty minutes and was divided into three ten minute periods. Seven defined behaviors were tallied by two observers simultaneously. The proportion of behaviors indicative of investigation and stress revealed when an animal had adjusted to the new situation, i.e., after adjustment, investigative behaviors consistently predominated over behaviors indicative of stress. Each elephant adjusted differently to the novel situation. This study then merely documents the obvious; elephants should be slowly introduced to and observed in novel environments.

INTRODUCTION

Despite observations of African elephants in the wild, seminatural habitats, and in captivity, no documentation exists of an animal's adjustment to temporary separation from companions and transfer into novel surroundings (Douglas-Hamilton, 1975; Adams and Berg, 1975). Nonetheless, a captive elephant is likely to face such a novel situation at least once, if not several times, throughout its life.

In order to conduct various psychological tests on the African elephant (Loxodonta africana), it was necessary to isolate the previously unseparated subjects and allow them to adjust to a specially designed room. This made the subjects appear excited. In stressful situations it has been noted that an African elephant exhibits ear extensions, trumpeting, and agitated forms of locomotion (Adams and Berg, 1980; Berg, 1983; and Kuhme, 1962).

The purpose of this study was to describe the adjustment process in terms of changes in certain behaviors so that a standard could be used to tell when an animal was suitable for further research or other zoological purposes.

MATERIALS AND METHODS

Subjects

The subjects were two female African elephants named Cinda and Steph, each approximately ten years old and in good health. Both were born wild in East Africa and have lived at the Sedgwick County Zoo, Wichita, Kansas since 1972.

Apparatus

The new environment was a holding room adjacent to the elephants' main living quarters. The room is approximately 1400 square feet, was constructed with an escape hall, heated floor, and lights and was off-public viewing.

Procedure

Sessions were conducted before or after the elephants' normal daily routine. Only the animal keeper was allowed to transfer and handle the elephants. Although the subjects were both physically and visually separated, it was still possible for them to hear and presumably smell one another. For the first seven sessions, a small amount of alfalfa was provided in the holding room for positive reinforcement. Also, immediately following the sessions, both elephants were rewarded with additional food.

As soon as a subject was securely shifted, the observation session began. Cinda was observed during September and October of 1980, whereas observations of Steph were conducted in July of 1981. Both elephants were observed for fourteen sessions. The days between sessions ranged from 1-4 days for Cinda and 1-2 days for Steph, with the average intervals 2.7 and 1.6 respectively. Also, Steph was initially so stressed that the first three sessions were shortened to only twenty minutes.

Observations were made from the hallway, approximately three meters from the perimeter of the holding room. The sessions were divided into three ten-minute periods. To check for inter-observed validity, observations were simultaneously recorded by two observers. The following are the descriptions of the behaviors scored; the behaviors previously described by Kuhme, 1962, Adams and Berg, 1980, and Berg, 1983, are indicated by an asterisk (*).

Ear extensions--both ears move forward rapidly to or beyond a position which is perpendicular to the body axis.*

Trumpeting--vocalization; loud-sounding air expulsion.*

Agitated locomotion--sudden, swift body movements; complete or incomplete circles or whirls; head shakes; kneeling or pawing.*

Rumbling--growl or purr; type of vocalization produced deep in the throat.*

Investigation--reaching of trunk into different areas; manipulating objects; sniffing, i.e., when subject is not feeding or engaged in other specified behaviors.*

Ramming bars--charging or backing into bars; counted only when sound was produced.

Several other miscellaneous behaviors were observed, such as, tailwagging and temporal gland secretion, but they were not sufficiently measured for analysis here.

Control observations were made when two elephants were together during their normal daily routine. Controls for Cinda were made in the outdoor exhibit, whereas control observations of Steph were made in the enclosed exhibit. The outside exhibit had no bars for the elephants to ram.

RESULTS

Comparison of the scoring by two observers showed a high correlation which ranged from .87 to .95 for four behaviors, i.e., ear extensions, trumpeting, agitated locomotion, and investigation (Spearman-Rank Test). Both elephants exhibited the same general behaviors during the sessions, but they differed in the frequency of certain acts (Table 1). Although Steph trumpeted, extended her ears, rammed the bars, and investigated more often than Cinda, the only significant difference was in the frequency of ramming the bars (Mann-Whitney--U, $P < 0.01$). Cinda exhibited more rumbling sounds during the sessions than Steph, but this difference was not significant.

TABLE 1. MEDIAN FREQUENCIES OF BEHAVIORS

	Experimental		Control	
Behaviors	Cinda	Steph	Cinda	Steph
Stressful behaviors				
Ear extensions	5	4.5	4	5.5
Trumpeting	0	0	0	0
Agitated locomotion	2	4.5	0	0
Ramming bars	3.5	14.5*	0	0
Investigative behaviors				
Investigation	17	38.5	3	16.5
Other behaviors				
Rumbling	14.5	5	8	3.5
Tail-wagging	22	22.5	17	22

*$P < 0.01$

Both of the subjects showed a reversal in the predominance of stress and investigative behaviors over time. The proportion of investigative and stress behaviors for each subject are shown in Figure 1. The total number of stress behaviors was the sum of the frequencies of ear extensions, trumpeting, agitated locomotion, and ramming the bars. Cinda began to switch

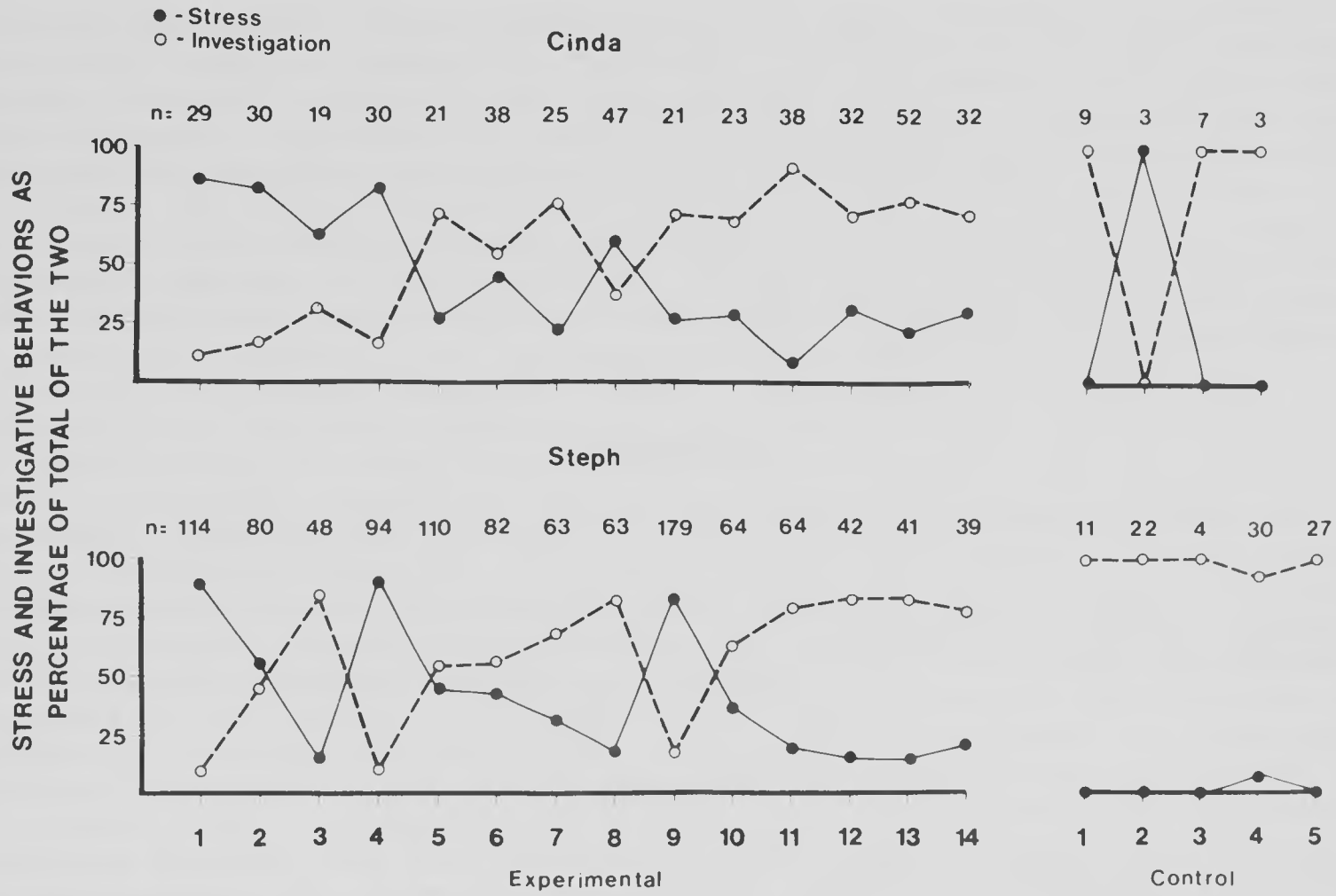

Figure 1. Comparison of changes in behavior during the course of the experiment shown by plotting the percentage of each of the total number of stressful and investigative behaviors combined.

from a predominance of stressful behaviors to one of investigation after the fifth session and investigative behavior became stable by the ninth session.

Although Steph showed a similar reversal, the pattern was different. In the first four sessions, there were oscillations in the stressful and investigative behaviors. At a point during each of the first three sessions, Steph became so agitated that it was deemed necessary to terminate the session early for the sake of the elephant's well-being. These oscillations, then, are an artifact of the way in which the behaviors were scored. As with Cinda, by the fifth session, investigative behaviors began to predominate. There was a reversal of this trend in the ninth session presumably caused by the presence of a third and unfamiliar observer.

Likewise, the predominance of investigative over stressful behaviors occurred throughout the control observations in all but one instance. In this situation the subject was pawing at the ground which was defined as part of agitated locomotion. This occurred in the outdoor exhibit and is frequently observed in wild elephants while dusting themselves (Douglas-Hamilton, 1975). Therefore, the context of this behavior does not suggest that the subject was stressed.

Within the session, analysis of the three periods showed each elephant was different in its response to the novel environment. Figure 2 compares the changes in investigation, stress, and rumbling after the ninth session when the elephants' responses had stabilized. Cinda showed a steady increase in investigative behaviors as the sessions progressed, whereas the frequency of rumbling decreased and ear extensions remained about the same. In contrast, Steph's investigative behaviors remained consistently high with very little change over the course of the three periods, and ear extensions showed a small decrease by the third period. Like Cinda, Steph also showed a steady decrease in rumbling.

DISCUSSION

In both elephants the predominance of behaviors indicative of stress and investigation reversed with repeated exposures. The only exceptions to this trend are caused by the shortened test sessions, the use of motor patterns (pawing) rather than context, i.e., pawing as a part of dusting process (Douglas-Hamilton, 1975), and presence of a strange observer. The adjustment process was only reliably shown by the comparison of proportion of behaviors indicative of investigation and stress. Ear extensions, agitated locomotion or ramming the bars occurred at least once in all the sessions; so behaviors indicative of stress did not completely disappear. The number of investigative behaviors varied with the sessions. On some days the elephants were more active than others. Nonetheless, by using the predominance of these two categories of behavior, it is clear that the subjects exhibited a

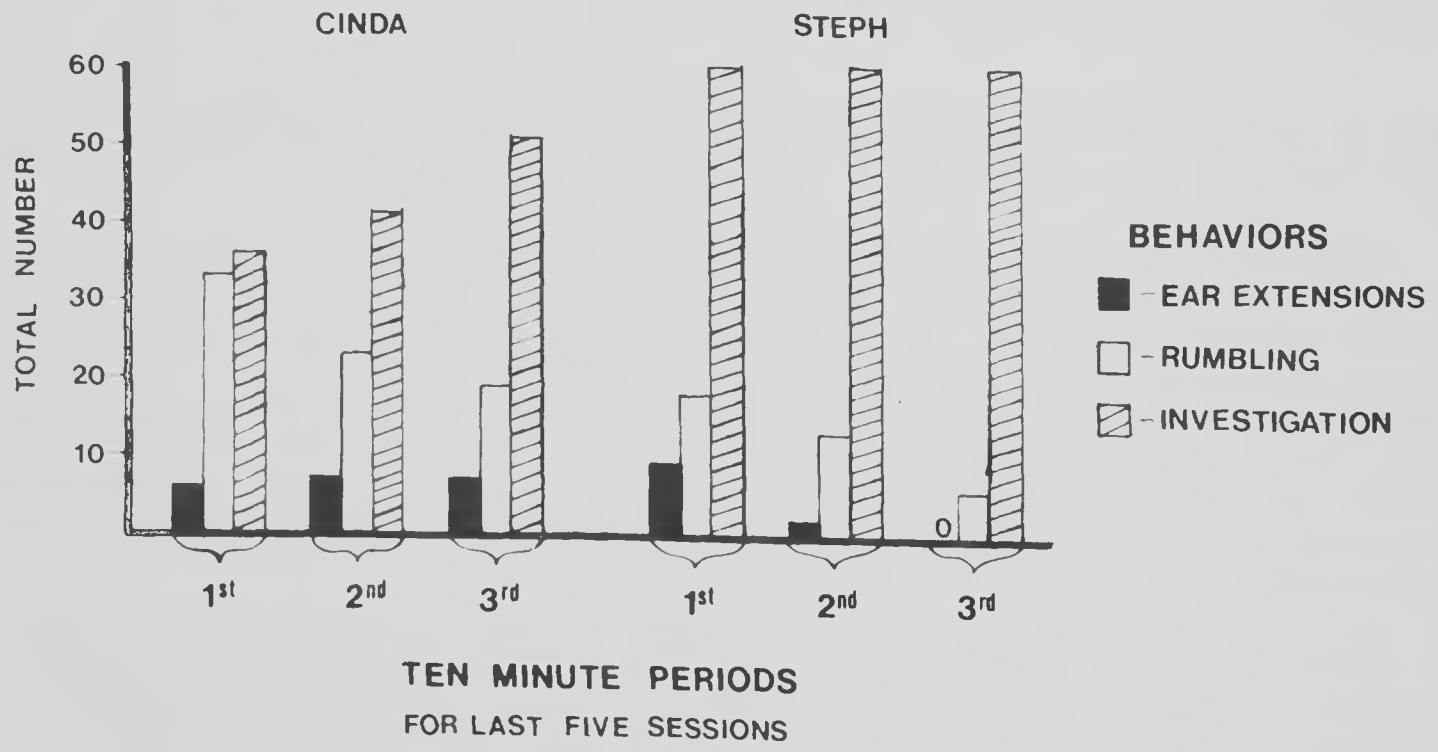

Figure 2. Changes in certain behaviors during the course of a session. Data are from the last five sessions for each subject.

stable adjustment to the novel enclosure by the ninth or tenth session. Also, each elephant showed a difference in its response to the novel enclosure within a session and with repeated testing. This difference in these responses may have been due to a dominance relationship. Steph has always been considered dominant over Cinda by the zoo staff.

It would be interesting to repeat and modify this study to include other biological phenomena. Tail movements by both subjects, and the variations therein, were very intriguing but unfortunately difficult to either measure or interpret. However, tail movements are one of the four broad groups of expression in animals (Hediger, 1968). Furthermore, secretions from the temporal gland were often observed but not quantified for lack of technique. Our understanding of stress and investigation in elephants will be incomplete without additional research on the entire myriad of behaviors these unique creatures display.

The determination of an elephant's adjustment to a novel enclosure using the proportional standard described here may be of use to other researchers as well as to zoo keepers in handling elephants.

SUMMARY

As the results show, both of the elephants gradually became accustomed to the novel situation in which they had been placed. Investigative behaviors increased over time while those indicative of stress diminished slowly. The reversal of the predominance of these two behaviors clearly indicates that habituation of the subjects to both the new surroundings and separation from their companion was occuring.

The observations also illuminated many individual dissimilarities between the subjects. The data analysed almost underestimates the amount of activity and the distinct repertoires of behaviors that the elephants displayed. Quantifying these behavioral expressions aids one in appreciating the unique aspects of these intelligent animals.

The significance of this study derives from the pattern of change in stressful and investigative behaviors. This information may be of value to those who wish to gradually and carefully acclimate elephants to new surroundings or situations in order to avoid possible danger to the animals, the people, or the exhibit area. This study then merely documents the obvious: that elephants should be slowly introduced to and observed in novel situations. It is hoped that the results of this study may be used by others who either want to prepare an elephant for veterinary care or conduct additional behavioral or psychological tests.

ACKNOWLEDGMENTS

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