1985

Individual Differences and Their Relation to Social Structure in Domestic Cats.

Rena Durr Mister

Louisiana State University and Agricultural & Mechanical College

Follow this and additional works at: https://digitalcommons.lsu.edu/gradschool_disstheses

Recommended Citation

Mister, Rena Durr, "Individual Differences and Their Relation to Social Structure in Domestic Cats." (1985). *LSU Historical Dissertations and Theses*. 4101.
https://digitalcommons.lsu.edu/gradschool_disstheses/4101

This Dissertation is brought to you for free and open access by the Graduate School at LSU Digital Commons. It has been accepted for inclusion in LSU Historical Dissertations and Theses by an authorized administrator of LSU Digital Commons. For more information, please contact gradetd@lsu.edu.

INFORMATION TO USERS

This reproduction was made from a copy of a document sent to us for microfilming. While the most advanced technology has been used to photograph and reproduce this document, the quality of the reproduction is heavily dependent upon the quality of the material submitted.

The following explanation of techniques is provided to help clarify markings or notations which may appear on this reproduction.

1. The sign or "target" for pages apparently lacking from the document photographed is "Missing Page(s)". If it was possible to obtain the missing page(s) or section, they are spliced into the film along with adjacent pages. This may have necessitated cutting through an image and duplicating adjacent pages to assure complete continuity.
2. When an image on the film is obliterated with a round black mark, it is an indication of either blurred copy because of movement during exposure, duplicate copy, or copyrighted materials that should not have been filmed. For blurred pages, a good image of the page can be found in the adjacent frame. If copyrighted materials were deleted, a target note will appear listing the pages in the adjacent frame.
3. When a map, drawing or chart, etc., is part of the material being photographed, a definite method of "sectioning" the material has been followed. It is customary to begin filming at the upper left hand corner of a large sheet and to continue from left to right in equal sections with small overlaps. If necessary, sectioning is continued again—beginning below the first row and continuing on until complete.
4. For illustrations that cannot be satisfactorily reproduced by xerographic means, photographic prints can be purchased at additional cost and inserted into your xerographic copy. These prints are available upon request from the Dissertations Customer Services Department.
5. Some pages in any document may have indistinct print. In all cases the best available copy has been filmed.

**University
Microfilms
International**

300 N. Zeeb Road
Ann Arbor, MI 48106

8526381

Mister, Rena Durr .

INDIVIDUAL DIFFERENCES AND THEIR RELATION TO SOCIAL STRUCTURE
IN DOMESTIC CATS

The Louisiana State University and Agricultural and Mechanical Col.

PH.D. 1985

University
Microfilms
International

300 N. Zeeb Road, Ann Arbor, MI 48106

INDIVIDUAL DIFFERENCES
AND THEIR RELATION TO SOCIAL STRUCTURE
IN DOMESTIC CATS

A Dissertation

Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy

in

The Department of Psychology

by

Rena Durr Mister

B.A., Louisiana State University, 1973

M.A., Louisiana State University, 1982

August 1985

To
Petsoits

ACKNOWLEDGEMENTS

First and foremost I would like to acknowledge the tremendous contribution of my sister, Virginia Durr, without whom this dissertation would have been impossible. Her contributions of cats, time, knowledge, ideas and wit made this undertaking almost pleasurable. Virginia is one of those people whose presence makes almost everything enjoyable and everything else at least bearable.

I must thank my husband for not only the long hours of holding the video camera on often motionless cats, but for patiently accepting my love for cats and their importance in my life. His understanding and support during my graduate work have been tremendous, and his acceptance of me and his willingness to listen have been indispensable for me.

I would like to express gratitude to my mother for her encouragement through graduate school and from my earliest memories. Her confidence in me has greatly influenced my life.

I would like to thank Dr. Nathan Gottfried, Dr. Donald Hoffeld, and Dr. Michael Fitzsimons for their interest and guidance and for the intellectual experiences they have given me during my graduate work.

I would especially like to thank Dr. Bill Seay for his interest in my desire to go to graduate school, his inspirational lectures on comparative psychology, his suggestion that I minor in zoology, and his suggestion that I talk with

with Dr. Fitzsimons.

Particularly I would like to express gratitude to Dr. Grant Young for his time, interest, knowledge, and consideration throughout my graduate studies. His contribution to my education and to my life has been invaluable and will never be forgotten.

TABLE OF CONTENTS

Dedication	ii
Acknowledgements	iii
List of Tables	vi
Abstract	vii
Introduction	1
Method	14
Results	19
Discussion	22
References	37
Vita	47

List of Tables

Table 1.	Schedule of the Experiment and Test Order	43
Table 2.	Kendall Correlation Coefficients (W) for Three Dependent Measures on all Tests where applicable	44
Table 3.	Spearman Rank Correlation Coefficients for all Combinations of Behavioral Measures	45
Table 4.	Experimental Subjects and Median Rank on Four Behavioral Measures	46

ABSTRACT

Two groups of domestic cats with established social structures were tested for their response to novel stimuli in a variety of test situations. Clearly observable individual differences in responses were seen which were consistent over a series of test sessions and remained stable despite regular environmental disruptions. Individual differences in behavioral response were found not to be related to object dominance (food competition) or social dominance (freedom of movement on social encounters) unlike similar studies with social animals. No relationship was found in either group between rank in object dominance and rank in social dominance. Significant correlations were demonstrated between latency to approach a novel stimulus, behavioral rank in test situations, and attention span in both groups of cats. Comparisons were made between similar studies with wolves and inferences were drawn about the relationship between individual differences and social structure in social and non social species.

INDIVIDUAL DIFFERENCES AND THEIR RELATION TO SOCIAL STRUCTURE IN DOMESTIC CATS

It is recognized that the behavior of animals often differs significantly among individuals according to sex, age, social role, health, and previous experience. Individual differences in behavior are considered important in determining the relative breeding success of an animal and its success in social relationships.

The purpose of the present research is to demonstrate stable individual differences in domesticated cats across a variety of test situations and despite variations in the social environment. Individual differences in behavior will be correlated to dominance in competitive and social situations to determine the relationship between dominance and other personality variables.

The Study of Individual Differences

The study of individual differences in humans is one of the oldest traditions in psychology, and according to Buss and Poley (1976), has recently undergone a renewal of interest. The stability of individual human characteristics has been extensively researched and documented (e.g., see Anastasi, 1965; Bloom, 1964; Brim & Kagan, 1980; Buss & Poley, 1976).

Although historically, little research interest has been demonstrated in regard to individual differences in

animal species below primates, individual differences in primates have been of interest (e.g., Simpson & Howe, 1980; Stevenson-Hinde, Stillwell-Barnes, & Zung, 1980). Even though individual differences among lower animals have not been a focus of traditional research, this is not to say that individual differences have not been recognized.

Since the beginning of laboratory research with animals the existence of individual differences have been recognized. For example, Maier and Schneirla (1935), summarizing research to date, state that the rate of learning in animals is a function of "individual differences in learning ability among animals of the same species" (p. 139). Maier and Schneirla go further to say that "diversity in temperament as well as physical structure must also be considered since these greatly affect performance of an animal" (p. 139). Although individual differences have long been recognized and accepted, they have been traditionally considered a source of interference and perhaps annoyance in the laboratory rather than an interesting topic for research.

Until very recently, isolated examples of individual differences in animals appeared only as casual observations mentioned in the context of more popular research topics as tool use. For example, Herald (1956) noted individual differences in the frequency and accuracy of spitting at target prey in archer fish and Goodall (1964) found considerable inter-individual variability in leaf sponging behavior in Gombe chimpanzees though neither Herald nor

Goodall was studying individual differences.

Areas of research interests change, however, and there seems to be a current surge of interest in animal behavior in general. This interest in animal behavior parallels a popular research interest in pet animals and their relationship with humans (e.g., Hart, 1976; Hyde, Kurdek, & Larson, 1983; Kidd, Kelly, & Kidd, 1983). Along with this interest a new body of scholarly literature is appearing which explores not only the traditionally taboo concepts of animal cognition and awareness, but also the subjective experiences of individual animals (see Griffin, 1981, 1984; Walker, 1983).

Not surprisingly, within the last five years, individual differences in animal behavior among a great variety of animal species have become the focus of an apparently growing number of studies. For example, recent endeavors include studies of individual variation in homing tendencies in minnows by Kennedy (1981), individual behavior associated with shell polymorphism in snails (Jones, 1982), individual differences in aggressiveness and foodstealing in oystercatcher birds (Goss-Custard & Durell, 1982), and the individual mating success of red winged black birds (Searcy & Yasukawa, 1983). Also, individual differences in traditional laboratory animals such as pigeons and rats are being researched (e.g., Babbini, Gaiardi, & Bartoletti, 1982; Harrison-Read & Steinberg, 1980; Oakscott & Glow, 1980).

Individual Differences in Classic Research with Cats

Cats have a long history as laboratory subjects although individual differences per se have not been investigated.

Thorndike (1898) used cats in his famous puzzle box experiments when attempting to formulate an explanation of the process of association in the animal mind. Although Thorndike was interested in the average cat's performance, he was forced to contend with individual differences. For example, Thorndike noted "vigor, abundance of movements was observed to make differences between individuals in the same situation" (p. 27).

Adams (1929) attempted to replicate Thorndike's original experiments and in the course of his observations noted large individual differences in the kind and amount of activity in the puzzle box. Adams attributed these individual differences to age, sex, physiological conditions and "the unanalyzed complex of native and acquired characters customarily lumped and called temperament in humans" (p. 91).

Guthrie and Horton (1946) in their *Cats in a Puzzle Box* studied each cat's individual process of learning to escape from the box. They concluded that what any animal will do at any moment is best predicted by what the animal was observed to do in that same situation when it last occurred. This conclusion suggests consistency in individual characteristics.

Cats have continued to be used as subjects in psychology experiments in such areas as discrimination learning (e.g., Schweikert & Triecher, 1969; Warren, 1969), environmental restriction (e.g., Fox, 1970), unfamiliar environments (Rheingold & Eckerman, 1971), and social interaction (Cole, 1960; Hart, 1974; West, 1974). However, cats have yet to be the subjects of an investigation on the nature, stability and consistency of their individuality.

Individual Differences and Social Structure in Animals

Several studies have demonstrated the relationship between individual behavioral responses and social structure in wolves. Fox (1972) found individual differences in behavior, emotional reactivity (timidity) and dominance status in four litters of wolf cubs. Fox was able to demonstrate a significant correlation between high social status and lack of timidity in test situations. The investigation suggested a strong relationship between individual variation and the enhancement of pack formation. Fox says that since the wolf pack is characterized by a highly polarized dominance subordination organization with varying degrees of dependence and subordination, behavioral heterogeneity ensures varied individuals able to assume varied social roles. Without such individual variation, pack organization would be threatened. Fox discusses evidence for greater behavioral homogeneity in less social canids arguing that evolutionary selection favors individual variation in

the behavior of social species.

Having suggested the important socio-ecological implications of individual differences in a social species, Fox followed the 1972 study with a successful attempt to correlate individual differences in exploratory behavior, prey killing, and social dominance with heart rate and reaction to stress in wolves (Fox & Anderson, 1973). Fox concluded that the observed physiological and biochemical correlates of individual differences are evidence for the innateness of temperament in each individual animal.

MacDonald (1983) investigated the stability of individual differences in wolves and the relationship among individual differences, the social environment, and social structure. MacDonald was interested in whether stability of the social environment is necessary to maintain the individual personality variables that form the basis of the social structure of wolves. MacDonald varied the social environment by housing the wolves alternately as a group, in pairs, and in isolation. The wolves were tested at various times for their reactions to unfamiliar people, unfamiliar objects, and in a bone competition test. Measures included latency to approach objects and people and the order of the animal's approach. Several findings were significant. First, a high degree of stability in individual behaviors was demonstrated throughout the experiment. Variability in behavior at an early age was followed by increasing consistency of behavior with age, a finding that is consistent with studies of human

personality development. Also, there was some suggestion that whether an animal is alone or with a social group affects performance on similar tests. This finding suggests that the social structure may be important for maintaining consistency of behavioral responses. MacDonald was able to conclude that continuity of the social environment is not necessary for the stability of the individual characteristics of the wolves, or to the stability of their social structure.

Social Structure and Dominance

The social structure of animal groups is intimately related to dominance relationships. In speaking of dominance, Klopfer (1974) says "despite differences in the degree, stability, or nature of the dominance relationship, the establishment of a convention of precedence goes far to assure the transformation of a mere assemblage into an organized society" (p. 155).

Traditionally, dominance has been inferred when one individual is able to inflict punishment on another without fear of retaliation and has been generally considered to be a function of sex, size, and physical condition (Klopfer, 1974). More recently, Zimen (1981) has specified dominance as the area of freedom or unrestricted movement that an animal has in relation to others. This is a useful conception because area of freedom can be measured by access to definite objects such as food or mates (object dominance) or measured by the amount of unrestricted movement in social

encounters (social dominance).

Individual differences in wolves have been seen to be consistently related to object dominance and social dominance as defined by Zimen. Fox (1972) reports that the most dominant members of wolf litters tended to be the most exploratory and less hesitant in approaching and investigating novel stimuli. Dominance in the Fox study was measured by competitiveness and success in monopolizing a bone. In support of Zimen's concept of social dominance, the alpha cub could be identified by its frequent displays of proximity intolerance, or restricting the movement of lower ranking animals in close social encounters.

MacDonald (1983) concluded that his data combined with that of other studies suggest that cub-cub relations reveal individual differences that are later associated with dominance in wolves. In MacDonald's study, the most dominant wolf cub (as determined by a bone competition test) was consistently less fearful to approach unfamiliar objects when the cubs were tested as a group.

Social Structure and Dominance in the Cat

The cat has been described as highly individualistic and asocial (Baron, Stewart, & Warren, 1957). Though recognized as individualistic, it has yet to be determined whether behavioral polymorphism is clearly delineated in the cat and whether certain behavioral traits are consistently related to dominance. According to Fox (1972), there would

not be the same evolutionary advantage of selection for individual differences in a nonsocial species in which there is no highly structured pack organization. Fox (1975), in discussing cat behavior, raised the question of whether a solitary species is capable of behavioral flexibility that is needed to adapt to more than one set of ecological variables.

There is evidence in wild felines for such behavioral flexibility. The lion is the only species of cat which often lives in social communities (Leyhausen, 1979). According to Alcock (1979), the lion is capable of living a highly social or solitary life depending on the ecological conditions. The direction of sociality depends on the immediate advantage of social foraging versus solitary prey capture.

Leyhausen (1965) claims that many mammals are capable of flexible sociality leading to either solitary or social lives depending on ecological circumstances. This flexibility comes from what Leyhausen believes to be a basic dualism in territorial dominance.

Based on naturalistic observations of cat colonies and groups of free living domestic cats, Leyhausen proposes that two types of dominance relationships are possible in many mammals. Leyhausen notes that cats ordinarily have an unstable undifferentiated dominance order headed by one dominant male with undifferentiated ranks below. Leyhausen calls this a relative dominance hierarchy. Leyhausen claims

that there is nothing automatic about the organization of social structure in cats, but that social structure depends on the individual characteristics of the cats concerned, the social situation, and the population density. Leyhausen maintains that although the relative dominance order is the usual state for casual social interactions, there is always an absolute ranking order for food competition and for certain resting places. Under crowded conditions, the relative dominance order gives way to a more or less absolute hierarchy with a direct relationship between the balance of absolute and relative hierarchy and population density. The same dualism in territorial dominance has been described in wolves (Schenkel, 1947).

Leyhausen's dualism helps to explain the small and conflicting body of literature on dominance in cats. Winslow (1938) was the first to describe dominance in cats based on observations of a laboratory cat colony. Winslow observed that the normal interactions of the cats did not involve a stable dominance hierarchy, but instead there appeared to be a single dominant male with undifferentiated ranks among the other cats. This observation supports Leyhausen's concept of a relative dominance hierarchy. Winslow then observed the cats in a food competitive situation in which they were required to take food from his hand. In this situation, the dominant male approached and ate first, with no particular order following him from which Winslow concluded that the ranking is relative in all situations. Here Winslow did not

take into account the individual cat's propensity to approach an unfamiliar person, a situation quite different from competition with other cats. Therefore, Leyhausen's claim of an absolute ranking in food competition is not seriously challenged.

Masserman and Siever (1944) and Baron et al. (1956) found clear linear dominance hierarchies in caged laboratory conditions where cats were required to compete for food.

Cole and Shafer (1966), who have done the most recent study of dominance in cats, concluded that cats maintain stable dominance hierarchies but that the particular hierarchy that emerges depends on the environmental conditions. Cole and Shafer observed cats in both a Wisconsin General Test apparatus (standard laboratory cage) and in a free environment situation. Stable hierarchies emerged in both situations for the same group of cats, but there was no relationship between the two hierarchies. In other words, two different unrelated ranking orders emerged for the same group of cats in the two different environments. Thus there is experimental support for Leyhausen's view that dominance depends on the social situation. Again in the Cole and Shafer study dominance was measured only in terms of food competition.

In summary, the small number of known experimental studies of dominance in cats have been based on food competition alone which Leyhausen says always demonstrates an absolute hierarchy and may be a special circumstance.

Leyhausen's view explains, then, why all experimental studies with cats report a linear (absolute) dominance hierarchy, and offers the experimentally untested notion that the absolute hierarchy may not be the case in all social situations.

In addressing the generality of dominance in cats, Masserman and Siever (1944) raise the question of whether dominance in food competition generalizes to other situations such as competition for water or mates, however Masserman and Siever did not attempt to answer their own question. Baron et al. (1956) found dominance in food competition to generalize to groups that were unfamiliar to the dominant cat. That is, a cat that was dominant in food competition in one group, remained the dominant individual when tested in food competition with a different group of cats. Other questions of the generality of dominance in cats have not been answered.

These early dominance studies with cats have reported consistently that dominance is not a function of sex, weight, or size which contradicts the traditional conception of dominance offered by Klopfer (1974), including Baron et al. (1957), Leyhausen (1979), and Masserman and Siever (1944). Also, overall dominance rank is reported not to be linked with aggression (Baron et al., 1956; Masserman & Siever, 1944; Winslow, 1938). However, dominance has been reported to be related to alertness, activity level, and assertiveness (Masserman & Siever, 1944) and rapidity of responding, energy

shown in responding, and number of threat behaviors (Cole & Shafer, 1966) which seem to be measures of aggression.

Summary

Earlier work both with cats and wolves described above (e.g., Fox 1972, 1975; Leyhausen, 1979) suggests that social structure may be determined by individual differences and characteristics of group members, and that these individual differences may be closely related to dominance.

In the present study, two groups of domestic cats with established social orders will be examined separately in an attempt to demonstrate stable individual differences in test situations and to determine if there is a relationship between social status and behavioral response in test situations. The social context of the test situations will be varied by testing the cats both alone and as a member of their respective social groups to learn if behavioral response is dependent on social context. It is expected that cats will exhibit stable individual differences, but that these differences may not be related to variables such as object dominance and social dominance usually associated with group role in social animals such as wolves.

This study will use test conditions involving novel stimuli similar to those used by Fox (1972) and MacDonald (1983) with wolves with necessary modifications for cats. These tests will measure what Fox and MacDonald have called exploratory behavior or "boldness".

METHOD

Subjects

The subjects were two groups of domesticated cats with separate and established social orders. Group 1 consisted of 11 cats, males and females ranging in age from 6 months to 11 years. Group 1 cats had been reared together by the same owner in a relatively space-restricted indoor environment comprised of four rooms in which the cats had complete freedom of movement.

Group 2 consisted of 11 cats, males and females, ranging in age from 8 months to 4 years. Group 2 cats had been reared in an unrestricted environment and were freeliving outdoors. All Group 2 cats belonged to the same owner and had the same territory, feeding location, and were accustomed to functioning as a group.

Members of both groups were either born into the group or had lived as a member of the group for at least 9 months. All cats were highly socialized to humans by having spent their critical period for socialization (age 5-7 weeks) in close contact with humans (Beaver, 1980).

Procedure

A preliminary assessment of behavior was made with both groups being tested in each test condition under their usual living conditions to establish normal behavior in test situations.

Following the preliminary assessment, the social environment of the cats was regularly disrupted to assess

whether environmental stability is necessary to maintain individual differences and the integrity of the established social structure. A 48-hour period of confinement and overcrowding alternated with testing sessions over the period of the experiment. Group 1 cats were confined to an unfamiliar room which forced proximity and social interaction. Group 2 cats were confined on a small screen porch. The purpose of confinement and overcrowding was to disrupt the preferred social environment of the adult cat that typically prefers solitude and avoids close social interaction (Beaver, 1983; Fox, 1975; Hart, 1976; Rosenblatt & Schneirla, 1962). See Table 1 for a schedule of the experiment.

Tests and Ranking Procedures

Social Dominance

Cats were assigned a rank based on amount of unrestricted freedom of movement they were allowed by other cats in social encounters (after Zimen 1981). During overcrowding situations, Leyhausen (1979) reports that a top ranking despot emerges who restricts the movement of others and social outcasts or "pariahs" emerge that are allowed no movement at all. These outcasts are attacked if they attempt any movement and are usually seen to crouch in a corner in a rigid defensive posture. Easily identifiable "despots" and "pariahs" existed initially in both experimental groups. Cats were assigned a social dominance rank in the following manner:

- 0 no movement allowed; attacked by others
if any attempt is made to leave corner
(social outcast)

- 1 some movement allowed, but is frequently attacked by others when movement is attempted
- 2 movement allowed but occasionally attacked by others for movement
- 3 unrestricted movement; never restricts others and is never attacked by others for movement
- 4 unrestricted freedom of movement and occasionally restricts others
- 5 unrestricted freedom of movement; frequently engages in restricting the movement of others

Object Dominance (Food competition)

The cats were deprived of food for 12 hours prior to testing in order to increase motivation and attempt to ensure a state of hunger in all animals. A highly desirable food item (e.g., turkey leg, chicken leg) was placed in full view of all of the cats in the group. Cats were scored for food competition in the following after Fox (1972).

- 0 no interaction
- 1 non competitive; investigates and ignores food
- 2 non competitive interaction; shares food
- 3 slightly competitive, but shares food
- 4 very competitive, but usually shares food
- 5 very competitive, and attempts to prevent others from sharing by aggressive threats and/or carrying food away from group

Novel Stimulus Group Test

For the testing session, cats were temporarily confined to a familiar enclosure while unfamiliar objects, such as moving remote control toys, small noisy electric appliances with moveable parts were placed one one side of an adjacent familiar enclosure. The order and latency of the cats approaching the unfamiliar objects were recorded.

Novel Stimulus Individual Test

Unfamiliar objects similar to those used in the previous group test were placed one side of a familiar enclosed area and the cats were placed individually on the opposite side. The latency to approach the unfamiliar object was recorded. The test was terminated after 3 minutes.

The behavioral measures for each cat in the Novel Stimulus Group Test were compared to the responses in the Novel Stimulus Individual Test to determine if performance on similar tests was dependent on social context.

Approach to Food in the Presence of an Intense Novel Stimulus

Highly desirable food was placed one side of a familiar enclosure very near an unfamiliar novel stimulus such as a very loud mechanical appliance (e.g., floor polisher, vacuum cleaner with aberrant noise). Order of cats approaching the food and latency to approach were recorded.

Unfamiliar Animal Test

An animal that was unfamiliar to the subjects (e.g., dog, rabbit, chicken, parrot) was placed inside a small cage in which it was highly visible to the cats and was placed

in view of the subjects in their familiar territory. Latency in seconds to approach the unfamiliar animal was recorded up to a maximum of 420 seconds.

Additional Procedures

No stimulus was used twice so that a different but comparable stimulus was used for each test session.

In addition to measuring order and latency of approach in novel stimulus tests, the cats were also measured on the following variables:

1. Attention Span. Attention span was defined as time in seconds spent in close contact investigating the stimulus.

2. Behavioral Rank. Each cat was assigned a behavioral rank on each test according to the following response criteria:

5 Positive active response. Immediate bold approach to stimulus with physical contact (e.g., nose or paw contact). No fear, intense interest. Includes playful interaction response.

Typical '5' walked quickly to stimulus and began to paw at stimulus immediately.

4 Positive inactive response. Short latency to approach with no fear, mild interest, but no physical contact and no playfulness.

Typical '4' walked calmly to stimulus, sat down and watched for several minutes with no interaction.

3 Neutral approach response. Approach to stimulus with no fear and little interest.

Typical '3' approached stimulus, investigated briefly and then left the area.

2 Negative active response. Slow approach with fear as evidenced by lowered body posture, rigid movements, pupil dilation, etc.

Typical '2' saw stimulus, sniffed the air, became very rigid and approached stimulus with lowered head and fixed stare.

- 1 Negative inactive response. No approach or approach at a distance. Fear or uncertainty evident by posture or hiding.

Typical '1' ran along wall farthest from stimulus to get in resting place or hiding place.

- 0 No interaction. No response. Ignores stimulus.

Typical '0' walked into the test area, ignored the stimulus and proceeded to usual resting place without looking at stimulus or responding to its presence in any form, as if the stimulus was invisible.

RESULTS

Kendall's coefficient of concordance ($\underline{W}$) was used to measure the relationship among behavioral rankings of the individuals over the five test sessions and the initial assessment of behavior. A $\underline{W}$ approaching 1.00 indicates agreement of the individual's rankings over the sets of ranking sessions (Siegel, 1956). Table 2 contains Kendall correlation coefficients for each of the five tests across test sessions for three separate dependent measures including latency of approach, behavioral rank, and attention span. Twenty-three out of twenty-four correlation coefficients were significant indicating consistency of individual rankings across test sessions on all three measures. The lowest $\underline{W}$ appeared for the latency of approach measure for the Novel Stimulus Individual Test for Group 1 ($\underline{W}=.28$, not significant). The Novel Stimulus Individual Test consistently produced the lowest correlations, ranging from .28 to .52, indicating somewhat less consistency in the cat's behavior

when tested alone. However, the Wilcoxon matched-pairs signed-rank test did not indicate a significant difference between an individual cat's behavior in the group situation and behavior when tested alone on any of the three dependent measures.

Spearman rank correlation coefficients were calculated between each cat's median rank across all tests and all test sessions on all combinations of the following variables: Latency of Approach, Attention Span, Behavioral Rank, Object Dominance, and Social Dominance. Table 3 contains a matrix of obtained Spearman correlation coefficients where it can be seen that the following relationships are significant: Attention Span with Behavioral Rank, $r_s = .93$, Group 1 and $r_s = .97$, Group 2; Latency of Approach with Attention Span, $r_s = .76$, Group 1, and $r_s = .88$, Group 2; Latency of Approach with Behavioral Rank, $r_s = .72$, Group 1, and $r_s = .90$, Group 2. These correlations can be interpreted as meaning that the same cat in each group was the first to approach, the most positive and aggressive in its actions toward the stimulus, and spent the longest time investigating the stimulus as a general rule.

It is of interest to note that Spearman rank correlation coefficients between object dominance and social dominance were very low for both groups and did not approach significance. Also, neither dominance measure was significantly correlated with Latency of Approach or Behavioral Rank in test situation, unlike similar studies with wolves.

Table 4 lists subjects by age, sex, median rank in Object Dominance, Social Dominance, and median Latency of Approach. From the data, there are no relationships among age, sex, and rank in Object or Social Dominance. Thus as previous research has suggested (e.g., Baron et al., 1956; Leyhausen, 1979; Masserman & Siever, 1944), age and sex are not reliable predictors of dominance status in cats. Also the lack of a relationship between median rank in Object Dominance and Social Dominance is apparent from the data in this table. In addition, the data clearly illustrate that neither dominance measure is closely related to rank on median Latency or median Behavioral Rank, but the correspondence between median Latency and median Behavioral Rank can be seen,

Behavioral observations suggested that Groups 1 and 2 may have differed in overall lack of fear in test situations and competitiveness of response in food competition. Group 2 cats seemed to respond less positively overall to test situations, however, a Mann Whitney U test which compared median Behavioral Ranks for each group, did not indicate a significant difference. Lack of fear in test situations may also be reflected by latency to approach unfamiliar novel stimuli, and although Group 2 cats appeared more fearful in general, a Mann Whitney U test for median Latency of Approach between Groups 1 and 2 was not significant. More aggressive displays were seen in food competition for Group 2 cats, but a Mann Whitney U test between median ranks in Object Dominance for Groups 1 and 2 did not indicate a significant difference.

DISCUSSION

A comparison of the behavioral responses of two groups of domestic cats in a variety of test situations has confirmed that domestic cats show clearly observable individual differences that are consistent over time and test situation. The consistency of behavioral responses was seen despite regular disruptions of the social environment which suggests that stability of the social environment is not necessary to maintain the stability of these individual differences. Since neither individual differences nor social status fluctuated significantly during the course of the experiment, it is suggested that the observed individuality is the expression of inherent personality traits and not simply the release of responses created by a certain set of stable environmental variables.

There was no suggestion that whether a cat is alone or with a social group affects performance on similar tests unlike the behavior observed in social animals such as wolves (e.g., Fox, 1972; MacDonald, 1983). However, somewhat less consistency of behavioral response was seen when comparing performance on individual tests to group tests and, though the difference in behavior was not statistically significant, some interaction of personality and social environment is suggested. In accordance with MacDonald's wolves, cats are seen to show slightly more variability of rankings in a non social context which supports MacDonald's suggestion that social structure has an affect on consistency of the rankings

even in an asocial species.

All patterns of results were present in both groups of cats suggesting reliability of the relationships that were examined. The inclusion of two groups of cats was for replication purposes and enhancement of external validity. Therefore one goal of the present study was to demonstrate similarities between Groups 1 and 2. Although several comparisons of behavioral observations suggested differences between the groups in terms of bold and competitive responses, no statistical differences between were found. These slight observed behavioral differences between Groups 1 and 2 will be discussed in more detail at a later point.

Observational data from the group test situations indicated that the cat's behavioral responses to a novel stimulus were independent of each other, that is, observational learning about the "safeness" of a stimulus did not occur. This phenomenon has been called local enhancement by Hinde (1970) and refers to an increased tendency to respond to part of the environment as a consequence of another individual's response. Since observational learning has been reported in cats (Beaver, 1980; Chesler, 1969; Rosenblatt & Schneirla, 1962), it might have been expected that the cats would take cues from each other so that a more fearful individual would observe a less fearful individual touching a novel stimulus and begin to approach. This observation of the lack of local enhancement in cats

contrasts with studies of wolves. Fox (1972) suggests based on behavioral evidence that within wolf groups there seems to be leader-follower relationships in which the more positively responsive wolves provide social reinforcement and facilitation for less responsive members of the group. The lack of local enhancement in cats may explain why the behavior of the cats was less variable than that of wolves when comparing results of individual tests to tests within a social context. The cat is more likely to make the same responses whether alone or with a group, whereas the wolf's responses change depending on social context.

A significant finding of the present study was that unlike wolves, the most dominant cats, as measured by rank in social dominance and success in food competition, were not the least fearful to approach unfamiliar novel stimuli. This finding was evident in both groups of cats. In Group 2, the cat that ranked the highest in social dominance also ranked highest in object dominance or food competition (a relationship not repeated in other individuals). However, this cat ranked last in latency to approach unfamiliar objects and was observed to be very fearful of all novel stimuli. Similarly, in Group 1, the cat ranking first in median latency to approach a novel stimulus ranked 8 out of 10 (1 = most successful) in food competition and ranked 6.5 out of 10 in social dominance when median ranks were computed across test sessions. Apparently in cats, there is no relationship between dominance and exploratory behavior

when assessed in these particular test situations. In addition, no relationship was found in either group between object dominance (traditionally defined dominance based on food competition) and social dominance (amount of unrestricted freedom of movement) as defined by Zimen (1981) with the notable exception of the one individual in Group 2 that ranked highest in object and social dominance. The lack of a relationship between these two measures of dominance is interesting since it would seem that dominance is based on aggression in either of its forms -- in competing for food or in restricting the movements of others, yet the correlations between object and social dominance were .23 and -.16 for Group 1 and 2 respectively. Apparently those cats that most aggressively engage in restricting the movements of others in purely social encounters are not the most aggressive in food competition situations which suggests that these forms of dominance are two different forms of aggression elicited by environmental variables that are independent of each other. It seems aggression is situationally dependent and not an inflexible stereotyped manner of dealing with every situation and may be evidence for the complexity of the interactions between environmental variables and internal personality variables in cats. Interestingly, Chauvin and Chauvin (1977) argue that in no animals should aggressiveness be confused or linked too closely with hierarchical rank. These authors suggest that individuals serve various roles in social relations and that

the same individuals do not assume all roles: the dominant animal is by no means dominant in all situations or in every kind of activity.

The present study suggests, as Leyhausen (1979) has asserted, that there is nothing automatic about the social structure of cat groups and that group structure depends on the individual characteristics of group members. For example, it cannot be said that the dominant individual is usually an older experienced male animal of a minimum size and weight that predictably elicits submissive behavior in all competitive encounters whether competing for food or the right of way on a well traveled path. There is certainly no predictable pattern of dominance in these two particular groups of cats.

The dominance relationships that exist in these two groups of cats seem somewhat less absolute than previous research has reported. All experimental studies to date with cats have investigated only object dominance (food competition) and observed absolute linear dominance hierarchies. In the present research, the dominance hierarchies in food competition were present and it was possible to rank each cat's behavior in terms of competitiveness, however, the cats were generally not as competitive as has been described in earlier laboratory studies (e.g., Baron et al., 1956, Cole & Shafer, 1966). The question arises as to the effects of socialization with humans on competitive behavior, since other studies have been done with laboratory cat

colonies.

Group 1 cats were more highly socialized (i.e. in terms of early and intense interaction with humans, exposure to novel stimuli, and behavioral modification for indoor living with humans) than were Group 2 cats as a whole. Group 2 cats were more fearful in general, had had fewer learning experiences with humans, and less exposure to novel stimuli of the type used in the test situations. Group 1 cats were less competitive in general especially in food competition than Group 2 cats that had had some experience competing for food. Group 1 cats had never had to compete for food and seemed unsure about how it was done. The first experimental food competition session with Group 1 after 12 hours of food deprivation, resulted in the turkey leg going to the cat nearest its placement at the beginning of the test with the others sitting patiently staring at the experimenter as if to say, "We are now ready for our turkey bones, please serve them!" Only after several minutes when it became apparent that no additional turkey legs would be served, did the other cats even attempt to investigate the one turkey leg. A behavioral progression was observed in which behavior went from somewhat more unorganized and unpredictable in the initial assessment and first sessions to quite predictable by the last test sessions. Statistically, the coefficient of concordance for the first 3 test sessions (including the initial assessment) was .78 compared to .91 for the last 3 sessions analyzed separately indicating that the initial

pattern that emerged became increasingly stable over the test sessions. It is suggested that Group 1 cats had to learn to compete and that a competitive response was learned or "unleashed" in those with the inclination and this response became very consistent as the tests continued. Group 2 cats showed approximately equal consistency when the first 3 sessions on food competition were analyzed separately from the last 3 (.79 and .70 respectively). Group 2 cats were also more aggressive in test situations in which unfamiliar animals were responded to as potential prey. Two tests were terminated due to aggression on the part of Group 2 cats. The two tests were unfamiliar animal tests, one with a 4 week old chicken, and one with a tame parrot. Both birds were caged, but the most bold cats successfully attempted to reach for the birds through the bars of the cage, and when injury to the birds seemed imminent, the tests were terminated. Group 1 cats did not show similar aggression and no tests were terminated due to aggression on the part of Group 1 cats.

Of interest in food competition was the willingness to share even after 12 hours of food deprivation, especially in Group 1 cats that somewhat unfortunately from the standpoint of the experimenter, had been taught to "take turns" when special food is being offered. Group 2 cats were less willing to share the prized food item, however, sharing frequently occurred. In both groups of cats, the cat monopolizing the bone relinquished it readily when

"satisfied" and did not attempt to guard it or use in dominance displays as do wolves (Fox, 1972; Schenkel, 1967). Once the dominant cat was satisfied, it gave up its dominance stance. Baron et al. (1956) found that feeding the dominant cat sometimes changes his dominance position which is not true of monkeys and other highly social animals. Apparently, dominance in food competition in cats as asocial animals reflects competitiveness for food and not a general tendency to use competitive situations to make statements about their social position.

Also of interest are the significant correlations between Latency to Approach, Behavioral Rank, and Attention Span, a pattern which was observed in both groups of cats. Latency measured how fast the cat approached, Behavioral Rank measured what the cat did after it approached, and Attention Span measured how long the cat stayed after the approach. At one level, the high correlations can be interpreted to mean that the cat that was the first to approach, was usually the most active and positive in its behavior toward the stimulus after its approach, and also was likely to stay interested the longest. Similarly, the cat ranking last in approach tended to be the least positive and/or active in its response, and spent the least amount of time investigating. On another level, it can be asked what is the significance of these individual tendencies in behavior as measured by these particular tests, and what is the significance of their relationship to each other?

In addressing these questions, a description of the test situations may be informative. Pilot tests indicated that tests that would be good discriminators of individual differences should not be too intense so as to remove all possibility of approach, or too neutral and produce no reaction. The best discriminators, in terms of producing a range of responses, combined two components: an attractive feature (usually movement) and an unattractive feature (usually moderate to loud noise). For example, one novel stimulus was an electric cake mixer with a large paper luggage tag attached to one of the beaters which flopped repeatedly as the beaters spun. The noise of the mixer and tag flopping violently scared some cats while others that were less fearful approached and batted playfully at the flopping tag.

One particular stimulus used for a Novel Stimulus Individual Test was so extremely attractive that it was a very poor discriminator. The stimulus was a very large cardboard box 5 feet tall and 3 feet wide with a cat size round hole approximately 1 foot from the ground. Nineteen cats out of 20 went directly and immediately to the hole as if mysteriously drawn to it. Nine cats out of 10 in Group 2 and 4 cats out of 10 in Group 1 not only approached immediately, but also jumped almost immediately into the hole and had to be removed from the box after the time limit. This test demonstrated remarkably unindividualistic behavior.

For the unfamiliar animal test, a good discriminator was a very large black and white laying hen which produced fear in some cats and intense interest in others. The tests that were good discriminators produced the widest range of responses between individuals. The nature of the test situations was such that a moderate change in a familiar environment created intermediate degrees of fear behavior and exploratory behavior.

According to Hinde (1970), fear behavior and exploratory behavior are overlapping categories of behavior, and are not (hypothetical) unitary drives. The behavior, whether fear or exploration, depends in part on the magnitude, intensity, or novelty of the stimulus involved, with a small change in the environment eliciting investigation and a major change fear. Therefore, it seems logical to conclude that the moderate degree of change or novelty aimed for in the test situations would produce an ambiguous situation in which vacillation might occur and individual differences in interpretation of the situation would become apparent. Based on the data, when faced with such ambiguous situations, the cats made the same types of decisions (in the direction of approach or avoidance) consistently. The question is what is different about the cats that went toward and explored the stimulus and those that avoided the test situations.

According to Hinde, the probability that a given situation will elicit exploration rather than fear depends

on various aspects of the animal's internal state. The incidence of exploratory behavior, then, is not solely dependent on stimulus factors, but also depends on internal factors such as experience, subjective perception of the intensity or novelty of a stimulus, and varying forms of motivation which may enhance or conflict with exploratory behavior. Any cat's particular reaction to a stimulus will depend in part, probably a large part, on the cat's internal state including inherent factors such as personality traits. Lack of fear, proclivity to interact with a stimulus and long attention span are apparently internal features that appear together, and may be representations of a common underlying factor. Attention span, fearlessness, and type of behavioral response may all be a function of one underlying variable such as degree of socialization. It seems plausible that such variables as boldness in test situations, confidence and attention span, may be a function of the cat's previous learning experience; i.e. the learning how to learn that is involved in socialization.

Another underlying factor that may be correlated with boldness, type of behavioral activity, and attention span is intelligence when defined as flexibility of response, adaptability to novel situations and the ability to profit from experience. These features of intelligence represent the prevailing view according to Hudon (1984) that animal intelligence must be evaluated on the basis of the usefulness of behavior to the animal in dealing adaptively to its

environment. It seems that the cat that is consistently first to approach a wide range of novel stimuli and spends a lot of time investigating and manipulating the stimulus is exhibiting mental activity described by Walker (1983) as an internal shifting and selection of information rather than exhibiting a stereotyped inflexible release of responses by a predictable set of environmental stimuli. The suggestion is that approach and interaction involve a less stereotyped response than avoidance or fear responses. The cats showed a wide range of approach and interaction responses while the range of avoidance responses was quite limited. Avoidance in its most frequent form consisted of running past the novel stimulus along the opposite wall to reach a resting place as far from the stimulus as possible. One particular cat made this response to every novel stimulus test except one; i.e., on 23 out of 24 occasions the cat made this inflexible response always running to the same resting place to which he had run on the previous tests.

In speaking of animal intelligence, Mason (1984) says intelligence is characterized by the ability to respond differently to a large domain of objects and events and by diversity of goals and motives which often appear remote in form and function from survival needs in the form of curiosity, exploration, and play. Behavioral Rank included a measure of playfulness since a rank of 5 included not only a bold immediate approach, but often was scored to include physical play with the novel stimulus which

frequently occurred in the most bold individuals. It is suggested that those individuals who approached quickly and remained interested playing with the stimulus were demonstrating more positive and flexible responses possibly characteristic of greater intelligence.

Is there a relationship between playfulness and intelligence? Fagan (1982) points out that the evolutionary significance of play is that play makes the player versatile and adaptable which sounds a great deal like intelligence. From an evolutionary perspective, Fagan adds that play develops and maintains behavioral adaptations to environments that offer novel benefits while "developing the ability to create new behavioral patterns and to test them for goodness of fit" (p. 379).

Hinde (1970) discusses play as a complex example of the diversity of motivational systems in animals and suggests that the study of play behavior may throw light on the nature of behavioral control in many contexts and "cannot be shrugged off" (p. 359).

Of course it cannot be concluded that the related variables here are measures of socialization or intelligence, but certainly more research is indicated to investigate the nature of and basis for the observed relationships between behavioral measures.

Hinde (1970) raises questions about the evolutionary selective significance of differences between individuals in intelligence or learning ability and powers of perception

and observes that these problems have yet to be tackled experimentally. The present study suggests that since cats clearly exhibit a variety of behavioral responses, they may serve as useful models for investigating the relationship between individual differences, social organization, and socio-ecological adaptations.

From the present study it may be concluded that clearly delineated individual differences are not the exclusive domain of social animals as Fox (1972) has suggested. Apparently there is an evolutionary advantage for selection for individual differences in non social species as well as in social species. In answer to Fox (1975) there is no question of whether a solitary species such as the cat is capable of behavioral flexibility needed to adapt to various ecological conditions. In the two small groups of domestic cats observed here, the range of behavioral response was great and suggests plasticity of behavior may be possible in domestic cats not unlike that seen in wild felines.

The difference between social and non social animals suggested by this study is that individual differences in social animals seem to be related to the variables associated with group structure and organization (i.e. dominance, leadership) Whereas in non social animals, individual differences certainly affect social relationships, but not in a predictable pattern that relates directly to group functioning or group cohesion. The function of object and social dominance in cats does not seem to be group cohesion

by reducing aggression as it is proposed to be in wolves, but seems rather to be almost the opposite in function. Social dominance and object dominance seem not to be part of the cat's typical repertoire of interactions but emerge out of extreme situations such as overcrowding or food shortages. Quite unlike its proposed function in wolves, social dominance in cats seems to have a dispersal function in that the lowest ranking individuals are driven off instead of being fitted onto the lowest rung of the social ladder; they simply leave or hide. Additional research is needed on overcrowding in cats to uncover a possible critical number of cats in a designated area that results in the eviction of social outcasts.

In comparing cats with wolves, the comparison is not only between social and non social, but also between non domesticated and domesticated. Studies with wolves (Fox, MacDonald, Zimen) have used captive wolves so that in comparing them to domestic cats, the comparison is between an organized group of wild animals "competing for survival" in an artificial environment, and an unorganized group of domestic cats not competing for anything more important than preferred window seats. Certainly research with feral cat populations in which the effects of socialization and domestication are much less evident would be not only interesting but necessary in attempting to make generalizations about the functional basis for individual differences and their relation to sociality from an evolutionary view.

References

- Adams, D. K. (1929). Studies of adaptive behavior in cats. Psychology Monographs, 27(6).
- Alcock, J. (1979). Animal behavior: An evolutionary approach. (2nd ed.). Sunderland, Mass: Sinaur Associated, Inc.
- Anastasi, A. (Ed.). (1965). Individual differences. New York: Wiley.
- Babbini, M., Gaiardi, M. & Bartoletti, M. (1982). Benzodiazepone effects upon Gelter-Seifer conflict test in rats: Analysis of individual variability. Pharmacology, Biochemistry, and Behavior, 17(1), 43-48.
- Baron, A., Stewart, C. N. & Warren, J. M. (1956). Patterns of social interaction in cats (*Felis domestica*). Behavior, 11, 56-66.
- Beaver, B. (1980). Veterinary aspects of feline behavior. St. Louis: C. V. Mosley Co.
- Bloom, B. S., (1964). Stability and change in human characteristics. New York: Wiley.
- Brimm, O. G., & Kagan, J. (Eds.). (1980). Constancy and change in human development. Cambridge: Harvard University Press.
- Buss, A. R., & Poley, W. (1976). Individual differences: Traits and factors. New York: Gardner Press, Inc.
- Chauvin. R., & Chauvin, B. M. (1977). (J. Diamanti, Trans.) Behavioral Complexities. New York: International Press, Inc.

- Chesler, J. (1969). Maternal influences in learning by observation in kittens. Science, 66, 901-903.
- Cole, D. D. & Shafer, J. N. (1966). A study of social dominance in cats. Behavior, 27, 39-53.
- Fagan, R. (1982). Evolutionary issues in development of behavioral flexibility. In P. P. F. Bateson & P. H. Klopfer (Eds.). Perspectives in Ethology, 5, 243-270. New York: Plenum Press.
- Fox, M. W. (1970). Neurobehavioral development and the genotype-environment interaction. Quarterly Review of Biology, 45, 131-147.
- Fox, M. W. (1972). Socio-ecological implications of individual differences in wolf litters: A developmental and evolutionary perspective. Behavior, 41, 298-313.
- Fox, M. W., & Anderson, R. V. (1973). Physiological and biochemical correlates of individual differences in the behavior of wolf cubs. Behavior, 46, 129-140.
- Fox, M. W. (1975). The behavior of cats. In E. S. E. Hafez (Ed.) Behavior of domestic animals (3rd ed.). (pp. 410-436). Baltimore, Md: Williams and Wilkins Co.
- Goodall, J. (1964). Tool using and aimed throwing in a community of freeliving chimpanzees. Nature, 201, 1264-1266.
- Goss-Custard, J. B., Durrell, S., Le V. dit & Ens, B. J. (1982). Individual differences in aggressiveness and food stealing among oystercatchers, Haematopus ostralegus L. Animal Behavior, 30(3), 917-928.

- Griffin, D. R. (Ed.). (1982). Animal mind-human mind. Berlin: Dahlem Konferenzen (Dahlem Workshop Reports).
- Griffin, D. R. (1984). Animal thinking. Cambridge, Mass: Harvard University Press.
- Guthrie, E. R., & Horton, G. P.. (1946). Cats in a puzzle box. New York: Rinehart & Co.
- Harrison-Read, P. E., & Steinber, H. (1980). Tricyclic antidepressant drugs and individual differences in the exploratory activity of rats: Contrasting effects of tertiary and secondary amine compounds. Psychopharmacology, 69(1), 85-91.
- Hart, B. L. (1974). Social interaction in cats. Feline Practitioner, 4, 12-20.
- Hart, B. L. (1976). Social interaction between cats and their owners. Feline Practitioner, 6, 6-8.
- Herald, E. (1956). How accurate is the archer fish? Pacific Discovery, 9, 12-13.
- Hinde, R. A. (1970). Animal behavior: A synthesis of ethology and comparative psychology. (2nd Ed.) New York: McGraw Hill Book Co.
- Hudos, W. (1982). In D. R. Griffin (Ed.) Animal mind-human mind. Berlin: Dahlem Konferenzen (Dahlem Workshop Reports).
- Hyde, K. R., Kurdek L., & Larson, P. (1983). Relationships between pet ownership and self-esteem, social sensitivity and interpersonal trust. Psychological Reports, 52, 110.
- Jones, J. S. (1982). Genetic differences in individual

- behavior associated with shell polymorphism in the snail Cepala nemoralis. Nature, 298(5876), 749-750.
- Kennedy, G. J. (1981). Individual variation in homing tendencies in the European minnow, Phoxinus phoxinus (L.) Animal Behavior, 29, 621-625.
- Kidd, A. H., Kelley, J. T., & Kidd, R. M. (1983). Personality characteristics of horse, turtle, snake, and bird owners. Psychological Reports, 52, 719-729.
- Klopfer, P. (1974). An introduction to animal behavior: Ethology's first century. (2nd ed.). Englewood Cliffs, New Jersey: Prentice Hall, Inc.
- Leyhausen, P. (1965). The communal organization of solitary mammals. Zoological Society of London. Symposium, 14, 214-263.
- Leyhausen, P. (1979). (B. Tonkin, Trans.). Cat behavior. New York: Garland Press.
- MacDonald, K. (1983). Stability of individual differences in behavior in a litter of wolf cubs, (Canis lupus). Journal of Comparative Psychology, 97, 99-106.
- Maier, N. R. F., & Schneirla, T. C. (1935). Principles of animal behavior. New York: McGraw-Hill Books Co., Inc.
- Mason, W. A. (1982). In D. R. Griffin (Ed.) Animal mind-human mind. Berlin: Dahlem Konferenzen (Dahlem Workshop Reports).
- Masserman J. H., & Siever, P. W. (1944). Dominance, neurosis, and aggression: An experimental study. Psychosomatic Medicine, 6, 7-16.

- Oakscott, J. G. & Glow, P. H. (1980). Genetic and environmental determinants of sensory contingent bar pressing in laboratory rats. Australian Journal of Psychology, 32(1), 31-43.
- Rheingold, H. L. & Eckerman, C. O. (1971). Familiar social and non social stimuli and the kitten's response to a strange environment. Developmental Psychobiology, 4, 71-89.
- Rosenblatt, J. S., & Schneirla, T. C. (1962). In E. S. E. Hafez (Ed.). The behavior of domestic animals. Baltimore: The Williams and Wilkins Co.
- Schenkel, R. (1947). Ausdrucksstudien an Wolfen. Behavior, 1, 81-130.
- Schenkel, R. (1967). Submission: Its features and function in the wolf and dog. American Zoologist, 7, 319-330.
- Schweikert, G. E. , & Triechler, T. R. (1969). Visual probability learning and reversal in the cat. Journal of Comparative and Physiological Psychology, 67, 269-272.
- Searcy, W. A. & Yasukawa, K. (1983). Sexual selection in red-winged blackbirds. American Scientist, 71(2), 166-174.
- Siegel, S. (1956). Nonparametric statistics for the behavioral sciences. New York: McGraw-Hill.
- Simpson, M. J., & Howe, S. (1980). The interpretation of individual differences in rheses monkey infants. Behavior, 72(3-4), 127-155).
- Stevenson-Hinde, J., Stillwell-Barnes, R., & Zung, M. (1980).

- Individual differences in young rhesus monkeys:
Consistency and change. Primates, 21, 498-509.
- Thorndike, E. L. (1898). Animal Intelligence: An
experimental study of the associative processes in
animals. Psychology Review Monographs, 4(supp. ii).
- Walker, S. (1983). Animal Thought. London: Routledge &
Kegan Paul.
- Warren, J. M. (1969). Discrimination of mirror images by
cats. Journal of Comparative Physiobiology, 69, 9-11.
- West, M. (1974). Social play in domestic cats. American
Zoologist, 14, 427-436.
- Winslow, C. N. (1938). Observations of dominance-subordina-
tion in cats. Journal of Genetic Psychology, 52, 425-
428.
- Zimen, E. (1981). (E. Mosbacher, Trans.). The wolf: A
species in danger. New York: Delacorte Press.

Table 1

Schedule of the Experiment and Test Order

Session	Day	Order of Tests*
Pre-session	1-5 6-7	Preliminary assessment of behavior confinement and overcrowding
1	8	5
	9	1
	10	2
	11	3
	12	4
	13-14	confinement and overcrowding

2	15	4
	16	5
	17	1
	18	2
	19	3
	20-21	confinement and overcrowding

3	22	3
	23	4
	24	5
	25	1
	26	2
	27-28	confinement and overcrowding

4	29	2
	30	3
	31	4
	32	5
	33	1
	34-35	confinement and overcrowding

5	36	1
	37	2
	38	3
	39	4
	40	5

- * 1 = Food competition (object Dominance)
 2 = Food with Novel Stimulus
 3 = Novel Stimulus-Group
 4 = Unfamiliar Animal
 5 = Novel Stimulus-Individual

Table 2

Kendall Correlation Coefficients (W) for Three Dependent Measures on all Tests where Applicable

Latency of Approach	Group 1	Group 2
Novel Stimulus-Group	W=.51 p<.01	W=.84 p<.001
Novel Stimulus-Food	W=.66 p<.001	W=.69 p<.001
Novel Stimulus-Individ	W=.28*	W=.52 p<.001
Unfamiliar Animal	W=.62 p<.001	W=.60 p<.001

Behavioral Rank	Group 1	Group 2
Novel Stimulus-Group	W=.62 p<.001	W=.59 p<.001
Novel Stimulus-Food	W=.69 p<.001	W=.66 p<.001
Novel Stimulus-Individ	W=.43 p<.01	W=.47 p<.01
Unfamiliar Animal	W=.45 p<.01	W=.52 p<.001
Object Dominance	W=.81 p<.001	W=.63 p<.001

Attention Span	Group 1	Group 2
Novel Stimulus-Group	W=.60 p<.001	W=.49 p<.01
Novel Stimulus- Individ	W=.33 p<.05	W=.36 p<.05
Unfamiliar Animal	W=.61 p<.001	W=.70 p<.001

*not significant

Table 3

Spearman Rank Correlation Coefficients for all Combinations
of Behavioral Measures

Group 1

	Object	Social	Latency	Span	Rank
Object					
Social	.23				
Latency	.63	-.03			
Span	.48	.31	.76*		
Rank	.34	.21	.72*	.93**	

Group 2

	Object	Social	Latency	Span	Rank
Object					
Social	-.16				
Latency	-.01	-.40			
Span	.01	-.46	.88**		
Rank	.09	-.35	.90**	.97**	

* $p < .05$

** $p < .01$

NOTE:

Object=Object Dominance
 Social=Social Dominance
 Latency=Latency to Approach
 Span=Attention Span
 Rank=Behavioral Rank

Table 4

Experimental Subjects and Median Rank on Four Behavioral Measures

Group 1

Name	Sex	Age	Social Dominance	Object Dominance	Latency	Behavioral Rank
Ansel	F	4	8.5	6.5	6	4.5
Bee Bee	M	3	8.5	1.5	3	8
Betty	F	5	4	4	4	4.5
Bicky	M	2	1.5	3	5	4.5
Boo Boo	F	4	10	10	10	9
Hinkey	M	11	4	9	9	7
Lorley	F	2	1.5	5	7	4.5
Mickey	M	1	6.5	8	1	1.5
Red Bob	M	3	4	6.5	8	10
Ricky	M	6 mos	6.5	1.5	2	1.5
Calvin*	F	4	0			

Group 2

Boy	M	10 mos	4	8.5	3	3
Bunny	F	10 mos	8	4.5	6	4.5
Elmo	M	10 mos	1.5	10	5	4.5
Fanny	F	2	8	6	4	7
Girl	F	2	4	4.5	9	8
Nancy	F	9 mos	8	2.5	1	1.5
Pooter	F	8 mos	8	7	7	6
Spanish	F	3	4	8.5	8	9.5
Susie	F	9 mos	8	2.5	2	1.5
Wernie	M	2	1.5	1	10	9.5
Sister*	F	1	0			

*Social outcast did not participate in experimental test sessions.

VITA

Rena Durr Mister was born in Memphis, Tennessee in 1950. She moved with her family to Biloxi, Mississippi in 1963, and then to Baton Rouge, Louisiana in 1967, where she graduated from Baton Rouge High School in 1968. Ms. Mister attended Louisiana State University from 1968 to 1973 when she received a Bachelor of Fine Arts in Painting with a minor in languages.

From 1973 to 1975 Ms. Mister completed requirements in the pre-veterinary medicine curriculum, and then was employed as a veterinary laboratory technician in avian pathology at the Louisiana State University School of Veterinary Medicine.

In the Spring of 1981 Ms. Mister entered graduate school in Psychology at Louisiana State University and received a Master of Arts in Experimental Psychology in the summer of 1982. Ms. Mister expects to receive the doctoral degree in Psychology in August of 1985.

DOCTORAL EXAMINATION AND DISSERTATION REPORT

Candidate: Rena Durr Mister

Major Field: Experimental Psychology

Title of Dissertation: INDIVIDUAL DIFFERENCES AND THEIR RELATION TO SOCIAL STRUCTURE
IN DOMESTIC CATS

Approved:

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

Date of Examination:

July 17, 1985