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STUDIES ON THE BASIC FACTORS IN ANIMAL FIGHTING:
VII. INTER-SPECIES COEXISTENCE IN MAMMALS*

c/o The Smithsonian Institution

ZING YANG KUO

A. PROBLEM

The purpose of this study is twofold: (a) to prevent the formation of certain anti-social habits in the dog and cat such as prey and hunting and killing of smaller animals, antagonism between dogs and cats, and fighting between and domination over members of the same species. And (b) to extend or transfer certain sociable behavior patterns to other species. Our ultimate goal was, of course, to establish a peaceful and tranquil mammalian society not only without fighting, but also with the dominance orders or social ranks eliminated. Throughout this investigation the developmental or ontogenic methods were used.

B. THE EXPERIMENTS

The subjects employed in these experiments were newly born puppies, kittens, albino rats, and rabbits. In addition, two species of very young birds, canaries, and cockatoos were included in this research. The subjects were divided into five main groups, each group was subdivided into nine pens, each pen consisting of one animal of one species and five of another species. Thus, in Group 1 Pen 1, one dog and five cats were reared together—see Table 1. The new born animals were put to live together in pens according to the plans of the study as soon as they were old enough to be hand-fed with cow's milk. The sexes of each group were, whenever possible, equally divided. Of the five groups, the first two were used as experimental subjects, the next two groups as controls, and Group V for the study of the effects of isolation on cats and dogs, other species were not involved in this group. Each pen in which six animals of two species lived together was placed in a wire net enclosure 18' x 18' x 10' (high). The detailed arrangements of the four groups are presented in Table 1. In the table, the letters *D*, *C*, *R*, etc. stand for dogs, cats, rats, etc.

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TABLE I
SPECIES AND NUMBER OF THE NEW BORN ANIMALS REARED TOGETHER IN THE SAME PEN

Species Pen No.	Cats (C) and cockatoos (Co) Pen 9	Cats (C) and canaries (Ca) Pen 8	Dogs (D) and canaries (Ca) Pen 7	Dogs (D) and cockatoos (Co) Pen 6	Cats (C) and rabbits (Rb) Pen 5	Cats (C) and rats (R) Pen 4	Dogs (D) and rabbits (Rb) Pen 3	Dogs (D) and rats (R) Pen 2	Dogs (D) and cats (C) Pen 1
I	1C 5Co	1C 5Ca	1D 5Ca	1D 5Co	1C 5Rb	1C 5R	1D 5Rb	1D 5R	1D 5C
II	1Co 5C	1Ca 5C	1Ca 5D	1Co 5D	1Rb 5C	1R 5C	1Rb 5D	1R 5D	1C 5D
III	1C 5Co	1C 5Ca	1D 5Ca	1D 5Co	1C 5Rb	1C 5R	1D 5Rb	1D 5R	1D 5C
IV	5Co 5C	5Ca 5C	1Ca 5D	1Co 5D	1Rb 5C	1R 5C	1Rb 5D	1R 5D	1C 5D
V	Ten dogs and ten cats reared in isolation								

respectively. The figures preceding the letters indicated the number of animals reared together in a pen; thus, 1D 5C means one new born dog reared together with five new born cats.

All the dogs in this investigation were short haired Chinese chows except in the experiments in connection with canaries and cockatoos when newly born Boston terriers were used. The cats belonged to the Chinese local breed. Whenever possible, effects were made to equally divide the new borns from the same litter between Groups I and 3 on the one hand, and between 2 and 4 on the other.

From our studies on the fighting of birds and our preliminary observations on the social behavior of various mammals we had come to the conclusion that competition over food, and over sex, playing activities, hostility towards strangers, and living in isolation were among the major environmental factors leading to the development of such anti-social behavior patterns as mentioned above. In this study, therefore, special emphasis was placed on the control of these factors during development. In the control groups (III and IV) no attempt was made to interfere with the spontaneous development of eating, and play activities of the subjects; these control animals were not allowed to see any strange animals until they were 10 months old. In Group V (dogs and cats reared in isolation) each subject was tested for its reactions to strange animals after they were 10 months old (dogs, cats, rats, rabbits, guinea pigs, canaries and cockatoos as well as several other species of birds and mammals).

1. *Socializing Eating Habits*

The object of this part of the investigation was to prevent competition over food by socializing the eating habits of the animals in Group I and II. Only dogs, cats, and cockatoos were used. The cockatoos were included in this study because they could be brought up to become very fond of bread soaked in milk which they could pick up from the food dish for dogs and cats. The procedure is briefly as follows:

When the dogs, the kittens, and cockatoos were about two months old, they were daily brought to eat by turn in the feeding platform the detailed ground plane of which is shown in Figure 1. All the partition walls and doors were made of plate glass. The walls are moveable so that the two compartments, *A* and *B*, as well as the alley way could be widened or narrowed according to the sizes of the animals. There were several sets of doors which could be changed in accordance with the sizes of the two compartments and the alley way. Each door was fixed with a spring hinge

and could be opened by pulling the string attached to it. When the string was released, the door closed immediately. Generally, Compartment *A* is so set as to have sufficient room for six animals to move and turn about. The alley way was set to allow only one animal to walk through at a

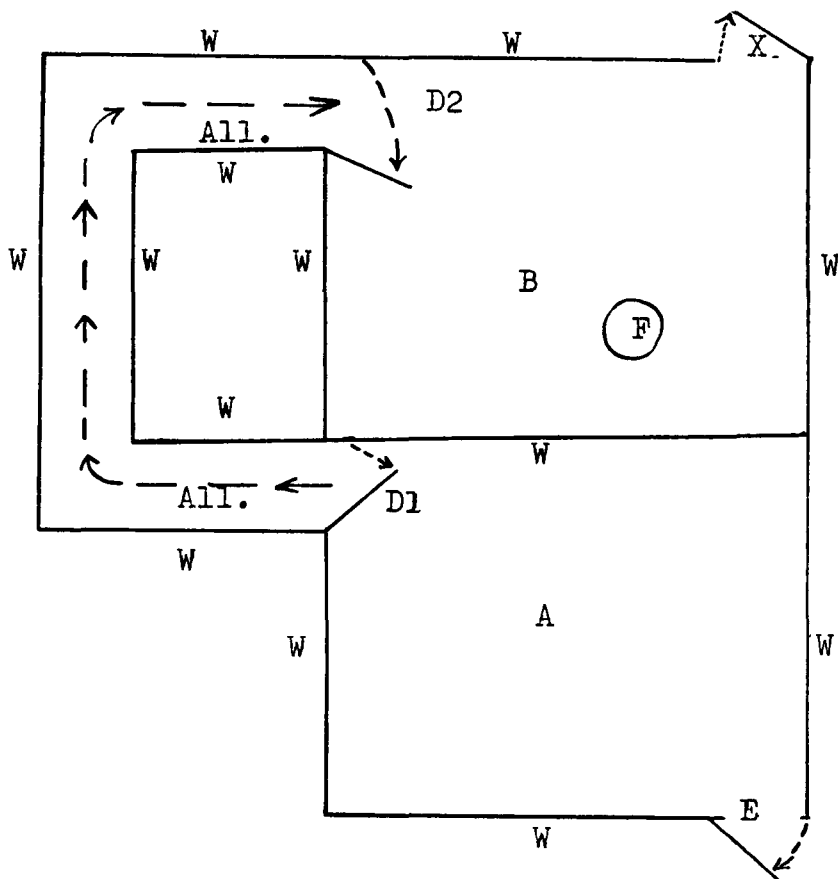


FIGURE 1
GROUND PLAN OF FEEDING PLATFORM

- E—entrance to the observation compartment.
- A—observation compartment.
- B—eating compartment.
- F—food dish.
- D1—glass door leading from *A* to alley way.
- All.—alley way leading from *D1* to *D2*.
- D2—glass door from alley way to eating compartment.
- X—exit from eating compartment.
- W—glass walls.

time so that if a second animal attempted to overtake the first one, it could do so only by squeezing or crawling under the first animal in front. When all the six animals (or five dogs or five cats only in those pens where rabbits or canaries were their coinhabitants) were brought into Compartment *A* through Entrance *E*, one of them was admitted through D1 the alley way and D2 into Compartment *B* to eat in the food dish (*F*) and the other five animals were allowed to watch the first admitted animal in eating. If any of the watchers became impatient and began to bark or meow, or tried to jump at the partition wall between *A*, *B*, a black curtain was lowered to cover the wall until all the impatient movements and noises in the waiting compartment were quieted down. The animal in eating was allowed to finish his meal in 10 minutes. After 10 minutes the bell rang, and the animal must leave Compartment *B* by the exit (*X*). Otherwise, he was gently pushed out through *X*. This done, another animal in waiting was allowed in the same manner to take his meal while the rest of the animals had to wait for their turn. After all the animals in the pen had learned to wait quietly in Compartment *A* for their turns to be admitted to eat in Compartment *B*, the next step in the training was to open Door D1 and let the waiting animals in Compartment *A* file one by one into the alley way while one was already eating in Compartment *B*. At first, the experimenter had to push them one by one into the alley way when the door D1 was opened. But later on all learned to do this without help as soon as D1 was opened. While lining up in the alley way, if one of the animals attempted to overtake another either by squeezing through or by crawling under, the overtaker was immediately brought back to the end of the waiting line.

After all the subjects had learned to line up in the alley way instead of Compartment *A*, each waiting for its turn to be admitted to Compartment *B*, door D2 was kept open. But if the animal in front of the waiting line rushed into Compartment *B* before the animal in eating had finished his meal and left the place, the door was immediately closed and the violator was taken up and replaced at the end of the waiting line. Through a number of trials, all the animals in the pen learned not to enter D2, though it was open, until Compartment *B* was clear of any animal.

One month after every animal in the pen had mastered "the dining car etiquette" (a nickname we used in the laboratory because the process resembled waiting in the dining car in a crowded American train) they were tested for their reactions to a food situation (not in the feeding platform) in which the other animals had either to wait beside the one in

eating, or to push him away in order to occupy the food dish which did not allow more than one animal to eat at the same time. Each subject was given three tests.

Since it is not our purpose in this report to analyse the learning process and due to space limitation, the records of the animals of these three species in learning the "dining car etiquette" will not be presented here. Suffice it to state that all the cockatoos, cats, and dogs in Groups I and II had eventually become "socialized" in their eating habit, and that the dogs were the quickest learners, the cats next, the cockatoos the slowest (three to 10 trials for the dogs, eight to 25 trials for the cats, 21 to 29 trials for the cockatoos).

In the three tests in a situation outside the feeding platform all the animals showed that the eating habits, that is, to wait, not to push, if the food dish is occupied, and not to compete with another while trying to reach the food dish which was just unoccupied were preserved even in a new environmental setting, although 56 per cent of the dogs, 42 per cent of the cats, and 33 per cent of the cockatoos often came so close to the food dish and made attempt to sniff at it, but neither the animal in eating objected to it, nor did the sniffer show any sign to join him in eating.

In the control groups (III and IV), no attempt was made to prevent fighting or domination in eating. The feeding plate was large enough for all the six animals in the pen to eat together. The phenomenon of food competition ending in domination without fighting or as a result of one or at most two fightings was observed in the two groups: (66 per cent for dogs, 68 per cent for cats, 48 per cent for rats, and 72 per cent for cockatoos). A dominant dog occupying the food plate or having a piece of food in the mouth would growl to warn off the other animals. A dominant cat would snarl or hiss. A dominant rat would bite another rat. The dominant cockatoo would peck or chase other birds away. The non-dominant ones (dogs, cats, as well as cockatoos) learned to quietly steal a piece of food and run to eat in a corner. A non-dominant cockatoo would steal with its beak one piece of food and put it to one of its feet to hold it, and with the free beak, steal another piece before it went away to eat the stolen food. All these happened when the dogs were about three to four weeks old, cats about four to eight weeks old, rats and cockatoos about two to three months old. All such behavioral phenomena were observed only during feeding time. At other times all the animals living in the same pen were friendly to each other, playing together, and even fondled or are attached to one another.

It would seem that there is a striking contrast in the behavioral patterns relative to the eating habit between the experimental and control groups.

2. *Play*

In the experimental groups, play of the animals was closely watched every day. The experimenter, with a water spray in hand (the kind commonly used in ironing clothes) would quickly spray water on the face of the animals as soon as fighting started during play. In the chow, puppies of three to four weeks would start to fight during play, or to bite at the handler, but with one to three sprays of water, fighting or biting would not occur again. We also employed water spray on a puppy carrying something in his mouth, who would growl or bite when another animal or the handler tried to snatch it from the mouth. However, in the case of play between cats, between cats and dogs, between dogs and cockatoos, and between cockatoos and cats, no fighting was ever observed. In the case of rabbits and canaries there are no acts which can be interpreted as play activities, except the preliminary and final sex acts.

In the two control groups, fighting between dogs during play was not stopped by the experimenter. But such fightings lasted often only for a few seconds rarely resulting in bodily injury, but might end with the establishment of the dominance relationship in favor of the stronger puppy.

In play activities there is one significant fact which must be pointed out here. There was no species barrier in play. The same kind of play patterns of a dog was manifested in the play either between a dog and a cat or between a dog and a cockatoo. Five of the puppies in all the first four groups even attempted at sham coitus movements on the cats or cockatoos or rabbits. The kittens displayed cat-like play patterns with cockatoos or with dogs. The cockatoos in playing with cats or dogs would nod its head, ruffle its crest, flutter its wings, touching the floor with its beak, attempting billing movements with a dog or a cat, or gently touch the face or neck of the dog or cat with its beak, making tender sounds in the meantime.

In inter-species social life while there is no species barrier in play as well as in attachment or fondling activities, nevertheless, there is still species preference. It will be noted that in the first four groups of animals in this investigation there are six animals of two different species living in one pen. Thus, in Pen 1 in Group I there were one puppy and five kittens living together; in Pen 9 Group I one cat to five cockatoos; in Pen 6 Group II five dogs to one cockatoo, etc. (see Table 1). Now, in the pen with one

cockatoo and five dogs, all the attachment, fondling activities, and play of the cockatoo were built around the five puppies. When all the puppies were taken out from the pen, the cockatoo became restless, making loud noises until one of the five puppies was returned to the pen. Even when a strange well-tamed cockatoo was put into this pen, instead of returning a puppy mate, the restless cockatoo adopted an indifferent attitude towards the stranger (or even hostile if the restless cockatoo belonged to Pen 6 Group IV instead of Pen 6 Group II). On the other hand, the attitude of the five puppies in the same pen towards this single avian pen mate can be described as "friendly, occasional playmate, but not indispensable." They did not play with the bird as much as they would among themselves. If four puppies were taken from pen leaving one of the five with the cockatoo, the lone little dog would become as restless and in great distress as if the avian pen mate were not there. The reversal of the same phenomena was observed in the case in which there were five cockatoos to one puppy in the same pen. In this case, the pup became attached almost solely to the cockatoos, acted as if they were his sole companions and play mates while indifferent to other animals including dogs. On the other hand, the cockatoos reacted to this lone dog with a tolerant and indifferent attitude. When two or four cockatoos were paired, their love making activities were confined to their sex mate, becoming indifferent not only to the lone dog, but also to the other cockatoos. And this applies to the relationship between kittens and cockatoos and between kittens and puppies throughout this investigation. In other words, when one young animal grows up together with mates of its species as well as a different species, it is more attached to the mates of its own species than to the mates of another species whereas when one lone young animal of one species is reared together with one or more young of a different species, after the critical time (two to three months), its attachment is in most cases entirely fixed with the mates not belonging to its own species so that when it meets a stranger of its own species its attitude is either indifferent or hostile depending on its past experience with strange animals.

3. *Sex and Fighting*

From the two previous sections we have noted that by socializing eating habit and by experimental intervention of fighting resulting from play activities, our experimental animals of Groups I and II had become practically "domination free" and "fighting free" and that although fighting and domination in eating and in play were observed in the two control

groups, they were quite mild and were rarely observed except during feeding time and during play. There was no antagonism between cats and dogs or between cats and rats or any other species used in this investigation. This is true not only of the experimental animals, but also of the control groups. But, now, when the animals in our investigation reached sex maturity, we were confronted with a much more complicated problem. In the first place, we had not succeeded in devising a satisfactory method of procedure, as we had with regard to eating behavior, to socialize sex behavior of the subjects. Secondly, from our past experience previous to this study, we had already known that in a sexually inexperienced but momentarily sexually aroused male chow, there was nothing we could do to stop him from his fierce struggle to reach the female in heat except by a very strong electric shock or an injection of a very heavy dose of estrogen to counteract the presumably momentary hormonal unbalance neither of which would serve our purpose in this type of investigation. Furthermore, fighting over sex between two male cats are frequently violent, and very much more so between two male chows. Such dog fights often ended in a serious injury to both or even death. In order not to upset the peaceful animal societies without or with very little social domination or fighting which we had built for more than 10 months, we decided to suspend our investigation on this aspect of behavior in dogs and cats. Whenever the first signs of the estrous cycle in a female dog or cat were noticed, the animal was immediately removed from the pen and kept in isolation until the receptive period was over (except in Groups I and III in which there was only one dog or one cat in a pen, and Groups V in which every one of the 10 dogs and 10 cats lived in isolation). (In other species in this study, fighting as a result of competition over sex had not been observed.)

C. PREY ON SMALL ANIMALS, HUNTING, REACTION TO STRANGERS, AND THE EFFECTS OF ISOLATION

Kittens and puppies in Group V naturally were not allowed to see any strange animal of whatever species during the period of isolation. From the tenth month on, each was tested bi-weekly for its reaction to strangers including dogs, cats, rats, rabbits, guinea pigs, a number of variety of parrots, canaries, and sparrows. Similarly, the control animals (Groups III, IV) had not seen any strange animal until they were 10 months old, and, thenceforth, each was given a bi-weekly test with the animals of those species used to test Group V. On the other hand, those animals in Groups I and II, from the start of their collective life in the pens were allowed

to spend 10 minutes every day with one strange animal of the various species used to test animals in Groups III, IV, and V. These testing animals had been trained to be very tame, having no fear or hostility to strange animals of any species, birds, or mammals but in most cases were very friendly to the animals in the pen they were introduced to visit. The reactions of the kittens and dogs of the five groups to the strange visitors are summed up in Table 2 (the reaction of other species were not presented

TABLE 2

Species of visitors									
Group and animals	No.	Types of reaction to visitors							
		Indif-ferent No.	Friendly No.	Hostile No.	Attack No.	Indif-ferent No.	Friendly No.	Hostile No.	Attack No.
		<i>Cats</i>				<i>Dogs</i>			
Group I									
Dogs	5	2	3	0	0	0	5	0	0
Cats	4	1	3	0	0	0	0	0	0
Group II									
Dogs	25	4	21	0	0	5	20	0	0
Cats	21	8	13	0	0	19	2	0	0
Group III									
Dogs	5	1	0	2	2	0	0	3	2
Cats	4	1	0	3	0	3	0	1	0
Group IV									
Dogs	25	2	4	12	7	2	2	8	13
Cats	21	2	2	16	1	4	0	19	2
Group V									
Dogs	10	0	0	6	4	0	1	4	5
Cats	10	1	1	6	2	2	0	6	2
		<i>Rabbits</i>				<i>Rats</i>			
Group I									
Dogs	5	4	1	0	0	3	2	0	0
Cats	4	4	0	0	0	4	0	0	0
Group II									
Dogs	25	5	0	0	0	10	15	0	0
Cats	21	20	1	0	0	18	3	0	0
Group III									
Dogs	5	2	0	0	3	2	0	0	3
Cats	4	3	0	0	1	2	0	2	0
Group IV									
Dogs	25	13	3	0	10	13	3	0	2
Cats	21	4	0	18	3	3	2	8	12
Group V									
Dogs	10	1	1	0	8	1	1	0	8
Cats	10	2	0	8	0	2	0	0	8

TABLE 2 (continued)

Species of visitors									
Types of reaction to visitors		Indif-ferent No.	Friendly No.	Hostile No.	Attack No.	Indif-ferent No.	Friendly No.	Hostile No.	Attack No.
Group and animals	No.								
<i>Guinea Pigs</i>					<i>Canaries</i>				
Group I									
Dogs	5	2	3	0	0	4	1	0	0
Cats	4	4	0	0	0	4	0	0	0
Group II									
Dogs	25	14	11	0	0	13	12	0	0
Cats	21	21	0	0	0	19	2	0	0
Group III									
Dogs	5	1	0	0	4	4	1	0	0
Cats	4	3	0	1	0	4	0	0	0
Group IV									
Dogs	25	9	0	0	16	14	11	0	0
Cats	21	8	0	8	9	16	3	0	6
Group V									
Dogs	10	2	2	0	6	4	1	0	5
Cats	10	4	0	0	6	5	0	0	5
<i>Sparrows</i>					<i>Parrots</i>				
Group I									
Dogs	5	5	0	0	0	1	4	0	0
Cats	4	4	0	0	0	4	0	0	0
Group II									
Dogs	25	13	12	0	0	8	17	0	0
Cats	21	19	2	0	0	20	1	0	0
Group III									
Dogs	5	5	0	0	0	4	1	0	0
Cats	4	3	0	0	1	4	0	0	0
Group IV									
Dogs	25	9	0	0	16	14	2	4	5
Cats	21	8	0	0	17	8	0	0	17
Group V									
Dogs	10	3	0	0	7	2	3	0	5
Cats	10	3	0	0	7	4	0	6	0

here as our primary interest in this investigation was kittens and puppies. The reason why other species such as rats, rabbits, canaries, and cockatoos were also used was because of the problem of prey on small animals, and hunting in dogs and cats.)

A glance at the table will reveal a number of important points: (a) Those cats and dogs which received a strange visitor every day from the very start of the collective life in the pen showed neither hostile nor attacking

reaction to the strange animals of any species during the testing period. Gone were their preying and hunting tendencies. Their reaction to strange animals was either indifferent or friendly. Gone, too, was the antagonism or hostile attitude between dog and cats. (*b*) But it is not the case with the cats and dogs in Groups III and IV with which no strange animals were allowed to pay visits. Upon tests, their reaction was by and large hostile or attacking. There were, however, a small number of cases in these two groups in which an indifferent or even friendly attitude was displayed by some of the dogs and cats. Our records show that these dogs or cats were the subjects which were brought up in the same pen with the animals which belong to the same species as the testing animals used as strange visitors to which the dogs and cats in question had displayed an indifferent or friendly attitude instead of a hostile or attacking reaction. (*c*) When we come to the dogs and cats brought up in isolation in the first 10 months, their reactions to strangers are predominantly hostile or attacking although there are a few cases in which the dogs or cats showed an attitude of indifference or a mild degree of friendliness. Our records show 10 cases in which small birds and rats were killed and eaten by the isolated cats, while the dogs chased and killed rats, guinea pigs as well as rabbits and birds. (*d*) The antagonism between cats and dogs, between two dogs and between two cats is very strong as an inspection of the reaction of the animals in Group V to visiting cats and dogs (Table 2) will show.

1. *Suppression of Aggression*

From Table 2 it will be seen that there are 22 dogs in Groups III, IV, and V which would rush to attack strange dogs whenever they were introduced into their enclosure. We purposely selected as visitors to these enclosures, dogs of extreme timidity who will invariably run to escape whenever the resident or residents of the enclosure rushed out and, when an escape was blocked, they would lie down on their backs and let the attackers attack without resistance.

Now, as a last step in this investigation, we made use of 20 (all chows) of these 22 aggressive dogs (the other two, Boston terriers) as experimental subjects on suppression of aggression. The suppressor was a medium sized, short-haired chow with a broad muzzle and with a bodily make-up excellent for a fighter. When we employed this chow as the suppressor for the 20 chow aggressors, it was about three years old. For all the three years of its life this dog never initiated a fight, but when attacked, never failed to make a counter-attack, and never lost a single combat. In any

environmental setting, familiar or unfamiliar, whenever he met one or more strange dogs or whenever one or more dogs rush to challenge him, his first and invariable reaction was to stand straight with his tail tightly bent forward to his back, making neither motion nor noise. Such a reaction pattern was in a majority of cases sufficient to send the challengers away without a fight. However, if he was attacked he always fought so well that unless he was ordered to stop by his trainer, the fight was finished almost always with a very serious injury, or death to his opponent. We made this three-year-old chow pay visits to those 20 chows by turn. In case of some mild injury or fatigue, the suppressor was rested until full recovery. Results: 13 of them (65%) were sent away peacefully by his firm and steady stand, the other seven got him into battles which were ended with three cases of severe injury, two cases of light injury, and two cases of death. After the wounds were healed, all these dogs were given four more tests with the suppressor as the visitor and with other new visiting dogs. Results: of the 13 which did not have any fight with the suppressor, six tried to keep in some distance from him, the other got near him but soon left him alone. All the 13 continue to challenge or threaten to attack other visiting dogs. All the injured dogs had the typical reactions of an underdog in the presence of the suppressor. All those which continued to have hostile or attacking reactions to the other dog visitors did so with a milder degree than before.

It must be noted in passing that in Groups III and IV when a top dominant dog or cat was removed from the pen the next dominant animal moved up to take its place as the top ranking animal. The hierarchy or rank order, remained constant until one of the dominant animals was removed.

D. SUMMARY AND CONCLUSION

In a number of experiments it has been demonstrated: (a) That in such anti-social behavioral patterns in dogs and cats as have been popularly known as prey on small animals, hunting, mutual antagonism between cats and dogs, aggressive or hostile reactions between two dogs, and hostility to or attacking strangers could be prevented from appearance if appropriate environmental situations were in force during development. (b) That sociable behavior patterns in mammals such as attachment to one another, fondling acts and courting could be brought to cross the species barrier and even extended from mammals to birds and vice-versa. This was accomplished also by the developmental or ontogenic methods. (c) That by adequate control of environmental conditions during development, eating

habits in dogs and cats and even cockatoos could be socialized to resemble human etiquette. (*d*) That during development by elimination of competitions over food, by prevention of fighting during play, and by avoidance of competition over sex, a mammalian society could be immunized against not only fighting but also what has been supposed to be a normal phenomenon in vertebrate animals, namely, the so-called dominance-submission relationship. (*e*) That in mammals as well as in fish and birds, isolation during development has been found to be a major factor in developing hostile reaction to other animals, which reaction is a step leading to fighting. (*f*) That in dogs (cats, also, the data concerning this are not presented in this paper) "standing firm" instead of running or submission has a 65 per cent chance to stop or avoid an aggressive attack. This confirms our findings in fish and birds. (*g*) And that in dogs, too, we confirm the conclusions based on the results of our investigation on fish and birds that an aggressor could be suppressed or subdued by a stronger or more powerful aggressor. But the suppression is never complete nor permanent, and rather costly as such a suppression may lead to severe injuries or even death. Here again, in mammals as in other classes of vertebrates, when the most aggressive animal is removed from the group, another moves up to take its place and established itself as the top aggressor. It appears, then, that suppression of an aggressor or removal of a dominant animal from the group will not end social domination or fighting in an animal society.

Our observation on the behavior of animals towards strangers raised some doubt about the validity of the concept of defense of territory in animals. We are rather inclined to think that the so-called "territorial defence" is, after all, merely a fancy name for the reaction patterns to strangers flavored with anthropomorphism and the 19th century Darwinism. Further and more systemic experimental explorations are necessary to decide this issue.

The results of our investigations on animal fighting have some bearing on the concept of species-specific behavior. We shall take up this question in another paper. (See Kuo—Neo-Behaviorism: A new approach to comparative psychology).

As has been repeatedly pointed out in the previous reports of this series, fixation of behavioral patterns (habituation) during development, plays an important role as a determinant of behavior. Its significance can not be overemphasized. It is an essential controlling factor not only in social domination and fighting but also in the development of behavior in general. We shall elaborate this point in the paper just referred to.

In conclusion, let us restate that although social domination and fighting are very common phenomena in animal societies, and although our studies have demonstrated that once such behavior patterns are formed and once the social hierarchy is established it is extremely difficult, if not impossible, to stamp them out, there is no reason to accept the fatalistic view that such behavioral patterns are "necessary evils" in social life. Our hope for a peaceful and tranquil society without fighting and social domination lies in the prevention of the development of such behavior patterns. Our findings have demonstrated that by appropriate control of environmental conditions during development we can immunize against certain types of anti-social behavior patterns in animals. We seem to be able to accomplish such an immunization without resorting to such drastic measures as depriving the animals of the essential nutritional factors such as thiamin or castration of the gonads. Our experimental attack on the various problems of the elimination of social domination and fighting is just beginning and further and more extensive investigations are required in order to work out a detailed and systematic program for the prophylaxis of aggression in animal society. However, the developmental or ontogenic approach seems to have encouraged us to hope that the day may not be so far off when it will be just as feasible to immunize against social domination and fighting as immunization against smallpox or poliomyelitis.

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