# IRRATIONAL FEARS IN THE DOG

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The theory of conditioned fear responses proposed by Watson (cited by Young, 29) has been rendered untenable by recent empirical observation. The experience of "uncanniness" has been stressed by English (5) as being an important feature of fear responses where no conditioning was possible. This position was also maintained by Valentine (27), who described a variety of situations in which fear was evoked, even though the native stimuli to fear proposed by Watson were not present.

Spontaneous fears of the uncanny have been adequately described in the chimpanzee. The information provided by Kohler (15), Yerkes and Yerkes (28), and Haslerud (7), has been recently extended by Hebb and Riesen (11), and Hebb (9). However, no comparable experimental knowledge exists for the dog.

## HISTORICAL BACKGROUND

The relationship between fear in the dog and the mysterious character of the stimulus situation has been recorded since the time of Darwin. An early observation by Thompson (26) that fright was induced in his dog by the sight of a tiger skin, marks the beginning of scientific interest in the spontaneous fears of the dog. Thus, the remark by Cobbe (3),

that "the bravest dog will continually show terror at the sight of an object which he does not understand, such as the skin of a dead monkey, the snake of a hookah, a pair of bellows, or a rattle," provided Darwin and Spencer with a psychological phenomenon valuable to the theory of evolution.

Subsequently, Darwin (4, p.469) described the avoidance by his dog of an open parasol which was being blown along a lawn by a slight breeze. The interpretation which Darwin accorded to this behaviour is characteristic of the anthropomorphism prevalent at that period: the dog "must have reasoned to himself in a rapid and unconscious manner, that movement without apparent cause indicated the presence of some strange living agent, and that no stranger had a right to be on his territory."

The recognition by Lindsay (16) that fear may arise from the sight of "unfamiliar", strange, new objects", gave rise to the experiments of Romanes. Romanes (24) reported some earlier experiments in which he was able to produce fear in his dog 1) by pulling a bone away from him by means of a long, invisible thread, 2) by a bursting soap bubble, and 3) by "making a series of hideous grimaces." Romanes had "no doubt that the behaviour of the

terrier arose from his sense of the mysterious."

Lloyd Morgan (20) duplicated Romanes' experiments and found no evidence of fear. The restrictions which Morgan proposed, in order to curb anthropomorphism, led to a more rigorous experimental approach. Thus, laboratories for animal study made their first appearance in North America. Fear of the mysterious in dogs was recorded by Mills (19) and in the meetings of the first society for the study of comparative psychology (22).

The restrictions of the laboratory, however, are not conducive to study of much of the spontaneous behaviour that animals may show in other circumstances. Consequently, other than Bingham's (1) description of a bird dog "fearfully reacting to turtles," no phenomenological investigations of the emotional behaviour of the dog have been reported in psychological literature in North America.

In continental Europe, however, the phenomenological tradition has persisted (13). Thus, Kohler (15, p.336) described the alternate avoidance and aggression manifested by a dog who was presented with a miniature stuffed donkey; Schmid (25, p.146)

recorded the fear in dogs of unfamiliar objects which appear suddenly and unexpectedly in their field of vision; and finally Buytendijk (2) postulated that "one of the most fundamental and instinctive reactions of a dog is its attack on moving objects."

In retrospect, spontaneous fears in the dog have been the subject of much speculation, although no experimental investigation has yet been reported. The purpose of this paper, then, is to demonstrate, experimentally, some of the stimulus situations which produce spontaneous fear in dogs, and to gain information about the strength of the fear aroused in dogs by the stimulation of innocuous objects. It is hoped that these data may help in the evaluation of current theories of the nature of fear, and toward the construction of a comparative psychology of emotion.

## EXPERIMENTAL METHOD

An investigation of spontaneous fears in an animal such as the dog, whose behaviour has been inadequately studied, centres around three methodological problems: 1) to obtain reliable and valid criteria for measuring fear; 2) to find objects and situations capable of producing fear, and yet not associated with painful experiences in the past history of the animal; and 3) to obtain a suitable means of presenting the test objects.

Because this was a preliminary study, no attempt was made to cover the entire range of objects and situations which produce spontaneous fear in dogs. However, a large number of objects were used, each with a small number of dogs. The behaviour of each dog was recorded as fully as possible during each presentation.

Criteria of fear behaviour. The criteria of fear behaviour which were employed in evaluating the experimental observations were: 1) when an approach of the object toward the dog produced a movement of its head, so that the dog's head was always at a right angle to the object; 2) when the animal crouched down, placing its head between its forepaws, and an approach of the object would cause

the animal to lower its head and press its ears against its neck; 3) when the animal would run away as the object approached, always attempting to keep it outside of its field of vision; 4) when the animal would run to the farthest part of the room, and maintain the greatest possible distance from the object when it was brought closer.

The reliability and validity of recognizing emotional behaviour in a particular animal by an individual familiar with the behaviour of that animal has been affirmed by Hebb (8). The criteria listed above were considered by the animals' caretakers, all of whom had intimately observed each animal for a period of at least two months. Each of the forms of response listed was found to be an indication of the degree of fear in the dog, and it was consequently given an arbitrary weight during the computation of the results from the collected descriptive data. Thus one point was given for criterion (1), 2 points for criterion (2), and so on. This weighting system is believed to provide a valid index of the degree of emotion manifest in the dogs' behaviour, and is also comparable to the weights used by Haslerud (7) for chimpanzees.

Test objects: The stimulus objects presented in this investigation fall into two major categories:

stationary objects, and objects involving movement. Some of the objects presented were intended as control material for the factor of motion in the presentation of the fear provoking test objects. Since no fear was observed with these objects, they will be mentioned briefly in the supplementary observations, and are not listed here.

A) Stationary Objects:

1) A mounted, coiled cobra, the largest coil being 6" in diameter.

2) A 12" stuffed toy lizard.

3) A 10" mounted fish.

4) The skin of a white horse, including half the tail and the mane, and retaining most of its original shape.

5) The skin of a white sheep. This was circular in shape and did not resemble the animal from which it was obtained.

6) Three skulls; a human, a chimpanzee and a dog skull.

7) A stuffed, yellow leather toy horse about 8" high.

8) A clothed plaster doll about 12" high with curly hair.

9) Familiar people wearing a mask of a witches face.

10) A 14" life-like bust of Byron.

11) A 12"-high red plaster elephant.

12) A life size bronze deer.

13) A 10" long wolf made of plaster, and painted green.

14) A 24" stuffed toy collie.

B) Objects Involving Movement

1) A wooden kitchen chair moved by very thin threads.

2) Soap bubbles bursting upon being touched by the animal.

3) A 3" high electric train.

4) A car that moved slowly along the floor, electrically controlled by a wire held in the hand.

5) A toy car with a spring mechanism that moved rapidly along the floor.

6) Three umbrellas; one having a 36" spread when open, another, 30", and a third, 24".

7) A balloon, blowing up to about 15" in diameter.

8) A person with head and body draped in a sheet, walking slowly.

9) A mechanical yellow turtle that waddled jerkily along the floor when pulled.

Subjects: A total of twenty-six dogs were used, ranging in age from two months to twelve years. The dogs were of various breeds: Scottish terriers, Dalmations, collies and cocker spaniels. The complete histories of most of the dogs were known, since they were all owned by apartment and small-home dwellers, and they were rarely permitted to go out of their homes alone.

Thus, the range of experience of these dogs was considerably wider than that of laboratory dogs, for they were reared in an environment that is normal for the domestic animal. Nevertheless, it was reasonably certain that the test objects were not associated with previous painful experiences.

Procedure: Since this investigation is primarily concerned with the nature of situations which induce spontaneous fear in dogs, it is necessary to be able to define that situation as well as possible. In order to eliminate any spurious factors which might contribute to the emotional behaviour of the dogs, testing was carried out in the homes of the animals whenever the experimental situation permitted it, and the owners of the animals helped in the presentation as much as possible. In situations where the animal was tested at the home of the experimenter, three 15 minute play intervals were given over a period of 3 days, before the test objects were presented.

The dog was led into a room illuminated by an ordinary lamp near which lay the test object. Each object was presented for a total of three minutes. For 15 seconds the dog was fed candy near the motionless object. The object was then moved slowly toward the dog for a 15 second period. In situations where the

test objects had movable parts, after being moved toward the dog, they were set into motion. The umbrellas were opened slowly over a period of 5 seconds. The remainder of the objects were set into motion for a 10 second period. For another 15 seconds the objects were moved slowly toward the dog. They were then placed on the floor for the remainder of the test period.

Since three sizes of skulls and umbrellas were used, they were presented to the dogs in random order. Thus the results, if different for each size, would not be due to adaptation to either the skull or the umbrella.

An interval of 10 to 15 minutes occurred between the presentation of the objects. No more than three objects were presented in a single day, and they were given to all the dogs in random order varying from dog to dog.

The large statue of a deer was situated on a street corner. The dog ran after the experimenter and, upon turning the corner, ran close to the deer.

## OBSERVATIONS AND RESULTS

The number of dogs whose behavior met each of the four criteria for avoidance listed earlier, is found in table I, for the stationary objects. Aggression responses elicited by these objects are found in table II. Thus, in a total of 98 presentations with stationary objects, 43 avoidance responses, and 16 aggression responses were recorded. Thirty-nine presentations elicited either a diffuse excitation which failed to meet the criteria for avoidance, or no emotional response. On the basis of the weight given each criterion, the total avoidance score for the stationary objects was 86, with a mean of 0.9 per presentation.

The number of avoidance responses to the test objects which had moveable parts are found in table III, and the aggression responses are listed in table IV. In a total of 137 presentations with these objects, 112 avoidance responses, and 8 aggression responses were recorded. The total score for these test objects was 369, with a mean avoidance score of 2.7 per presentation.

The difference between the avoidance scores for the stationary objects and the test objects involving movement was found to be significant at the 0.1 percent level.

A small number of dogs was used with each test object and the animals making up the experimental groups varied for some of the tests. Thus, the results in tables I and III should not be construed as containing exact information about the efficacy of each object in producing avoidance. However, the weighted scores for avoidance of each test object can be stated in terms of a percentage of the total possible score. This permits a rough comparison of the various objects in ability to induce avoidance behaviour.

In the table listing the objects without moving parts, the greatest percentage of fear was produced by the bronze deer, the horse skin and the owner wearing a mask. However, only 50 percent of the total possible avoidance behaviour was manifested in these situations, and only one dog met criterion 4, keeping the farthest possible distance from the test object.

It is interesting to note that, for the dogs tested, the human skull provoked much more fear than the chimpanzee skull, while the dog skull was not avoided by any of the subjects. This indication of the importance of size is further illustrated by the relatively high percentages of avoidance of the

large objects such as the bronze deer and the horse skin, while less avoidance was exhibited toward the smaller cobra, lizard, etc.

The different degrees of avoidance response to the three sizes of umbrellas, listed in table III, similarly indicate that a factor of size is contributing to the dog's avoidance of innocuous objects. This is also shown in the test in which a balloon was blown up slowly in front of the dogs. A generalized excitement in the dogs was recorded as the balloon increased in size. However, when the balloon was 6 to 8 inches in diameter, the dogs invariably jumped back a few feet and most of them continued to run away from it. The strength of response elicited by these objects with moving parts, is greater than that for the stationary objects. Thus, in the total 112 fear responses to the moveable objects, 93.8 percent of them were the strong, highly excited avoidance responses required to meet criteria 3 and 4. For the objects without moving parts, however, only 37.2 percent of the total 43 avoidance responses were of sufficient strength to meet criteria 3 and 4.

The manner in which the object is presented to the dog is important in producing the fear response. It was found that avoidance of the objects that had no

moveable parts, such as the skulls, the lizard, the doll, etc., occurred only when the objects approached the dog, but not when they were stationary. The deer was the only completely stationary object that produced avoidance. These observations suggest that olfaction alone was an inadequate stimulus to the fear response, since no avoidance was recorded when the test object (apart from the deer) was present, but stationary. Similarly, when a horse skin, which still retained the shape of a horse, was presented to the dogs in its usual capacity as a rug, no reaction was obtained. However, when the skin was placed over a sofa, giving the appearance of an upright horse, the fear response was produced. When later replaced on the floor, no reaction was observed. A sheep skin, which had an elliptical shape, produced avoidance in one of the dogs, indicating that the unusual situation of a rug lying on a sofa, and not the shape of a rug alone, may have contributed to the fear responses recorded with the horse skin rug.

It is important to observe the frequency of aggression as an emotional response to the test objects. This is evident in table II which shows that aggression was expecially manifest toward the smaller, stationary objects such as the dog skull, the cobra,

and the toy horse. The situation involving the opening umbrella, listed in table IV, was especially marked by aggressive behaviour, which followed the initial avoidance of the object.

The aggression which appeared in these tests was characterized by an excited approach toward the object with growling and snapping at the object, although in no test was any damage done to the stimulus object. This type of quasi-aggression ended as soon as the test object was hidden from the field of vision of the dog.

With many of the stationary objects, such as the bronze head of a man, the lizard, and the toy horse, some of the dogs manifested a diffuse, highly excited form of behaviour. Although rudimentary forms of avoidance and aggression were discernable, this behaviour was insufficiently coordinated to meet the criteria for either avoidance or aggression, and is not included in the tabulated results.

Adaptation to the stationary objects that produced avoidance immediately after presentation, occurred in some of the dogs by the end of the test period. The remaining dogs displayed a decrease in excited behaviour during the test period, and moved closer to the stimulus object. Except for the situations with the moving chair and the soap bubbles, adaptation

to the test objects with moving parts was not observed during the test period. However, after the strong initial avoidance to these objects, some of the dogs manifested a diffuse excitement after which they either attacked the objects or continued to avoid them.

Four dogs, whose results are not included in the tables, consistently remained unaffected by the test objects presented to them. Three of these dogs were under 3 months of age, and did not respond emotionally to any of the test objects. The fourth was a dog of the advanced age of 13 years, who avoided the balloon when it was blown up, but none of the other objects presented to him. The results of these four dogs were not tabulated since they were outside of the age range of the normal adult dog, and would have greatly affected the results.

TABLE I

THE NUMBER OF DOGS MEETING EACH CRITERION FOR AVOIDANCE OF OBJECTS WITHOUT MOVING PARTS.

| Stimulus Situation. | No. of Dogs. | No. and Weight of Criterion. 0 | 1 | 2 | 3 | 4 | Total Points. | % of Total Possible Points. |
|---|---|---|---|---|---|---|---|---|
| Cobra | 8 | 4 | 2 | 1 | 0 | 0 | 4 | 12.5 |
| Lizard | 8 | 3 | 4 | 1 | 0 | 0 | 6 | 18.8 |
| Fish | 8 | 3 | 3 | 1 | 0 | 0 | 5 | 15.7 |
| Skulls: | | | | | | | | |
| Human | 8 | 3 | 1 | 2 | 1 | 0 | 8 | 25.0 |
| Chimp. | 8 | 4 | 1 | 0 | 1 | 0 | 4 | 12.5 |
| Dog | 8 | 4 | 0 | 0 | 0 | 0 | 0 | 0.0 |
| Toy horse | 8 | 3 | 2 | 1 | 1 | 0 | 7 | 21.9 |
| Toy Collie | 8 | 2 | 1 | 2 | 1 | 0 | 8 | 25.0 |
| Doll | 5 | 2 | 0 | 0 | 2 | 0 | 6 | 30.0 |
| Masked man | 5 | 0 | 0 | 0 | 2 | 1 | 10 | 50.0 |
| Bronze bust | 5 | 3 | 1 | 1 | 0 | 0 | 3 | 15.0 |
| Elephant | 5 | 3 | 1 | 1 | 0 | 0 | 3 | 15.0 |
| Wolf | 5 | 2 | 1 | 0 | 2 | 0 | 7 | 35.0 |
| Horse skin | 3 | 0 | 0 | 0 | 2 | 0 | 6 | 50.0 |
| Sheep skin | 3 | 2 | 0 | 0 | 1 | 0 | 3 | 25.0 |
| Bronze deer | 3 | 1 | 0 | 0 | 2 | 0 | 6 | 50.0 |
| Totals: | | 39 | 17 | 10 | 15 | 1 | 86 | |
| Mean: | | | | | | | 0.9 | |

TABLE II

THE NUMBER OF DOGS SHOWING AGGRESSION TO OBJECTS WITHOUT MOVING PARTS.

| Stimulus Situation. | No. of Dogs. | Immediately after presentation. | After an initial avoidance. |
|---|---|---|---|
| Cobra | 8 | 1 | 1 |
| Lizard | 8 | 0 | 2 |
| Fish | 8 | 1 | 0 |
| Skulls: Human | 8 | 1 | 2 |
| Chimp. | 8 | 2 | 0 |
| Dog | 8 | 4 | 0 |
| Toy horse | 8 | 1 | 0 |
| Toy Collie | 8 | 2 | 1 |
| Doll | 5 | 1 | 0 |
| Masked man | 5 | 2 | 1 |
| Bronze bust | 5 | 0 | 0 |
| Elephant | 5 | 0 | 0 |
| Wolf | 5 | 0 | 1 |
| Horse skin | 3 | 1 | 0 |
| Sheep skin | 3 | 0 | 0 |
| Bronze deer | 3 | 0 | 0 |
| Totals: | | 16 | 8 |

TABLE III

THE NUMBER OF DOGS MEETING EACH CRITERION FOR AVOIDANCE OF OBJECTS WITH MOVING PARTS.

| Stimulus Situation. | No. of Dogs. | No. and Weight of Criterion. 0 | 1 | 2 | 3 | 4 | Total Points. | % of Total Possible Points. |
|---|---|---|---|---|---|---|---|---|
| Moving chair | 8 | 4 | 0 | 0 | 4 | 0 | 12 | 37.5 |
| Soap Bubbles | 8 | 3 | 0 | 2 | 3 | 0 | 13 | 40.6 |
| Car with battery | 8 | 1 | 0 | 0 | 7 | 0 | 21 | 65.6 |
| Toy car | 8 | 1 | 0 | 0 | 2 | 4 | 22 | 68.8 |
| Balloon | 8 | 0 | 0 | 2 | 5 | 1 | 23 | 71.9 |
| Sheet on person | 8 | 2 | 0 | 1 | 3 | 2 | 19 | 59.4 |
| Mechanical turtle | 8 | 1 | 0 | 2 | 4 | 1 | 20 | 62.5 |
| Electric train | 3 | 1 | 0 | 0 | 2 | 0 | 6 | 50.0 |
| Umbrellas 36" | 26 | 2 | 0 | 0 | 8 | 15 | 84 | 80.8 |
| 30" | 26 | 1 | 0 | 0 | 11 | 12 | 81 | 77.9 |
| 24" | 26 | 1 | 0 | 0 | 16 | 5 | 68 | 65.4 |
| Totals: | | 17 | 0 | 7 | 65 | 40 | 369 | |
| Mean: | | | | | | | 2.7 | |

TABLE IV

THE NUMBER OF DOGS SHOWING AGGRESSION TO OBJECTS WITH MOVING PARTS.

| Stimulus Situation. | No. of Dogs. | Immediately after presentation. | After an initial avoidance. |
|---|---|---|---|
| Moving chair | 8 | 0 | 0 |
| Soap Bubbles | 8 | 0 | 0 |
| Car with battery | 8 | 0 | 4 |
| Toy car | 8 | 1 | 2 |
| Balloon | 8 | 0 | 1 |
| Sheet on person | 8 | 0 | 2 |
| Mechanical turtle | 8 | 0 | 3 |
| Electric train | 3 | 0 | 0 |
| Umbrellas 36" | 26 | 1 | 2 |
| 30" | 26 | 2 | 6 |
| 24" | 26 | 4 | 11 |
| Totals: | | 8 | 31 |

## SUPPLEMENTARY OBSERVATIONS

In order to be sure that the factor of motion in the procedure was not by itself a sufficient stimulus to the avoidance response, rubber balls and pieces of wood corresponding in size to the skulls, toy horse, doll, etc. listed in table I, were presented to the dogs. The procedure was similar to that employed for the objects without moving parts, but no avoidance was recorded when they were moved slowly toward the dog. Consequently, motion, in the presentation of the test objects that had no moving parts appears to be important in getting the attention of the animal, but is not a sufficient cause of avoidance behaviour. This is corrobrated by Buytendijk (2) who observed form discrimination in dogs after about fifty trials when the form was set into motion, but not when it was stationary, (cf.12). This investigation however, suggests that form and object discrimination may occur on the first presentation, since the dogs avoided the test objects on the first trial, but did not avoid the control objects.

To better understand the contribution of motion the tests with the toy car and electric train were repeated. A sudden movement of these objects produced greater avoidance than a slow steady increment

in speed. This same factor of suddenness also played a role in the umbrella test, for a greater emotional response was produced by opening an umbrella rapidly, than when opened over a 5 second period. Similarly a less intense emotional response resulted from opening the umbrella over a 10 second period as compared with the 5 second period.

With the umbrella test, it was found that the fear response occurs no matter what the direction in which the umbrella is opened. The strength of avoidance, however, does vary with the direction of opening. With all the tabulated objects that have moveable parts, then, the factor of motion appears to have a subliminal value in producing fear. To effect avoidance the motion must be supported by other aspects of the test object. Motion, however, may have a liminal value in producing avoidance. For, it has been observed that many of the dogs will avoid <u>any</u> object that moves rapidly and directly toward them.

With an untested group of dogs, the following experiment was performed: An opened umbrella was carried into the room which contained the dog. The umbrella was closed, and after 15 seconds it was opened again. It was then placed on the floor for 15 minutes until it was carried out. No fear response occurred during this time,

but rather, the umbrella was sniffed at and pushed around by the dog. This was repeated for another 9 trials of 15 minutes per day except that the umbrella was never closed. On the 11th day the umbrella was closed in front of the dog. Avoidance responses were produced in three of five subjects. Although the test was continued for another 6 days with the remaining two dogs, no fear response was elicited by closing the umbrella.

A repetition of the opening umbrella test was carried out with those dogs who attacked the umbrella after the initial avoidance. Umbrellas having a 24" and 36" spread were used. They remained open for a five minute period instead of the 3 minutes of the main experiment. It was found that the time of onset of aggression varied with the size of the umbrella. Avoidance of the smallest umbrella was followed by aggression about one minute after opening, and of the largest, approximately 4 minutes after opening. Two sets of dogs were used for each of the two sizes of umbrellas.

Individual differences were evident in all of these tests. This was further exemplified in a test with a toy mechanical car, and a hat or a cardboard box. After adaptation to the moving car was manifest in 5

dogs during the main experiment, a cardboard box was placed over the car. It was then set into motion, giving the appearance of the box's moving along the ground. The result was an excited alternation of avoidance and aggression in 3 of the dogs, which continued until either avoidance or aggression developed as a consistent pattern of response. Two of the animals attacked the car and cardboard box upsetting it, and one continued to avoid it.

## THE NATURE OF THE IRRATIONAL FEAR

The observations and results of this investigation can be utilized in better understanding the nature of the irrational fear. Our knowledge of this type of fear, both factual and theoretical, revolves around two central problems: 1) the properties of the stimulus situation which is adequate to cause the fear response, and 2) the way in which the stimulus situation acts on the organism to produce avoidance and related emotional behavior.

In the course of experimentation on visually aroused avoidance, various properties of the stimulus situation were suggested. Thus Kohler (15) suggested of chimpanzees that "not only what has been experienced, or recognized as really dangerous, inspires fear in these animals, but also anything which has the phenomenological character of aggressiveness and 'awfulness'-- especially when there is the added factor of the strange and the unknown."

Yerkes and Yerkes (28), also studying the chimpanzee, wrote:" the stimulus characters which early or late are dominant in the determination of the avoidance response are: visual movement, intensity, abruptness, suddenness and rapidity of change in stimulus or stimulus complex.

In studies with humans, Jones and Jones (cited by Young, 29) suggested that a combination of the familiar with the unfamiliar produces fear. Similarly, English (5) argued that it was the uncanniness of a situation that causes fear, and Valentine(27) stressed the subjective experience of the mysterious as causing spontaneous fear in children.

Little information was accumulated after these studies to ascertain the properties of the fear provoking stimulus. The interest shifted from the stimulus object to the organism itself. In a paper designed to show the importance of the central nervous system in determining fear,Hebb (9) proposed an hypothesis which clarifies some of the main issues in the problem. Although the fear of snakes and certain small mammals by chimpanzees is left unaccounted for, the mysterious, the uncanny and the strange are explained as causing "a disruption of a coordination, principally acquired, in the timing of cellular activities in the cerebrum." This gives rise to avoidance, aggression, or other forms of behavior depending upon which response better restores integrated cerebral action. Thus the spontaneous fear is accounted for, not in terms of the stimulus complex, but rather as the effects of conflict, sensory deficit and constitutional change on the temporally and spacially organized cellular activities of the cerebrum.

The results and observations of the present investigation elucidate a number of points concerning the nature of the irrational fear.

That a type of learning, other than conditioning, is prerequisite for the "spontaneous" avoidance response has been pointed out by Hebb and Riesen (11), and Hebb (9). Further validation of this type of early learning is found in the umbrella test. A series of presentations of an open umbrella was required before avoidance was incurred by closing the umbrella. Since no fear response occurred as a result of closing the umbrella after its first presentation, learning of the type indicated by Hebb (9) must have taken place during the periods of visual stimulation by the test object. This is also indicated by the rapid adaptation made by some of the dogs following the initial avoidance of the stationary objects.

Learning also must be taken into account in considering the type of response which the animal gives to the stimulus object. In the test involving the toy car that was covered by a cardboard box, some of the dogs initially exhibited highly excited behaviour during which they ran back and forth near the car and box. When the test object came close to them, they backed

away and then excitedly came forward again. This continued until they consistently approached the car and box or avoided it. The approach culminated in an attack on the test object, upsetting it. Later presentations of the box and car were marked by a continued decrease in the time of vacillation. At the third or fourth test period, the dog immediately attacked the test object or avoided it, indicating that the integrated part of the emotional pattern (i.e., attack or retreat) was established at least in part by learning.

Two variables of the stimulus situation that contribute to spontaneous fear in dogs are 1) the size of the object and 2) the speed with which an object is set into motion.

1) Spatial factors. The importance of size is demonstrated by the different effects of presenting large or small skulls and umbrellas. In tables III and IV it can be seen that the large umbrella tended to produce avoidance in the dogs, while aggression was more frequent when the small umbrella was opened. The supplementary observations further indicate that the time relationship between avoidance and aggression toward the open umbrella is affected by the size of the umbrella. Similarly, avoidance and aggression varied with the size of the skulls presented. Furthermore,

the largest percentages of avoidance in table I are produced by the large objects such as the bronze deer, and the horse skin, while the least avoidance was produced by the dog skull, the cobra and other small test objects.

Consequently, if the fundamental source of fear and rage is a disruption of coordinated cerebral activity, as suggested by Hebb (9), size appears to contribute in determining the type of behavior that will become dominant to restore coordinated cerebral activity.

The test involving the blowing up of a balloon indicates that an object may have to attain a particular size before it disrupts the activity in the cerebrum. In this investigation, a diameter of 6 to 8 inches appeared to be the crucial size for dogs. This test however, allows no conclusions to be drawn about the size alone, for the factors of motion and change of shape in the test object must also be taken into account.

2) Temporal factors. Speed as a variable in the situation which provokes spontaneous fear, has been demonstrated by the supplementary tests with the car, train and umbrella. The degree of avoidance in the dogs was found to be affected by the "suddenness" of movement, indicating the important liminal and

sub-liminal fear values of motion.

Spatial and temporal factors alone, however, do not account for the emotion provoking character of the test objects which were avoided or attacked. The classification of specific fears proposed by Hebb (9) suggests that fear of the strange is due to "conflict:.. strange objects arouse incompatable perceptual and intellectual processes" in the cerebrum, which give rise to the manifest emotional behaviour. Thus, when the horse skin lay on the floor, it was ignored by the dogs. But, when it was placed upright it was avoided. This fear of the strange is also obvious in situations such as a chair moving without apparent cause, masks on familiar people, and other situations which involved an unfamiliar combination of familiar things or a transition of familiar objects into unfamiliar ones.

## THE COMPARATIVE PSYCHOLOGY OF FEAR

In a recent paper, McBride and Hebb (17) have suggested that motivation and emotion may provide a better index of phylogenetic relationships among animals than problem solving and intelligence tests.

McBride and Hebb compared the porpoise with other mammals and concluded that the behavioural hierarchy was: man, chimpanzee, porpoise, cat or dog and laboratory rat. Since the material provided by the present investigation is pertinent to such a comparative study, the spontaneous fears of the dog will be compared to the visual arousal of fear by inanimate objects in other mammals reported in the literature.

The close relationship which exists between man and chimpanzee when spontaneous fears of inanimate objects are used as the criterion, has been reviewed by Hebb (9). These fears are persistent and visually aroused by a great variety of objects. Haslerud (7) found that there was no statistically significant difference between the number of fears visually aroused by animate and inanimate objects in adult chimpanzees. A significant difference, however, was found for children chimpanzees, who reacted to all moving objects, but never to inanimate ones. These results were later corroborated by McCulloch and Haslerud (18) with

chimpanzees reared in social isolation.

The porpoise's fear of visually perceived, inanimate objects has been described by McBride and Hebb as taking 24 to 48 hours to subside, thus placing the porpoise close to, but below the chimpanzee in behavioural level.

The dog, as the results of this investigation indicate, is below both the chimpanzee and man in the susceptibility to fear of inanimate objects. It has been statistically shown that fear of inanimate objects is less frequent and intense than the visually aroused fear of moving objects. The brief duration of these fears in the dog, would also tend to place the dog below the porpoise. It has also been observed that the individual dog's emotional behaviour is less variable than that described of the chimpanzee (9, 15). Similarly, the mode of behaviour of any particular dog, from time to time, is not as variable as that of the adult chimpanzee.

Haslerud (7) has pointed out that slow adaptation is a characteristic of the adult chimpanzee while children chimpanzees adapt swiftly. Since Haslerud's criteria of avoidance are comparable to those here used with the dog, it is interesting to note the similarities in behaviour between the adult dog and the child chimpanzee.

The question of the rat's visually aroused fear of cats and snakes is highly ambiguous at present (14,21,23). There is no question, however, that the rat is on a lower behavioural level than the dog.

Although emotional behaviour provides a valid comparison of disparate species, when two closely related species as the horse and the dog are compared, the index of fear of innocuous objects does not provide a true picture. For, Grzimek (6) reports terror in horses upon perceiving a horse skin crudely packed with straw or panels representing horses of natural size. Grzimek's description of the strength of fear induced by these objects, and the length of time the fear persisted, would place the horse above the dog in the phylogenetic level.

In order to obtain a complete picture of the behavioural level of an animal such as the dog, the other senses, especially the olfactory sense must be carefully investigated. Consequently a hierarchy of psychological complexity must be assumed to correspond not only "with gross differences in the size of the cerebrum, and the proportion of afferent to internuncial neural tissues" (10,p.125), but also with the level of sensory development of each particular species.

Since the cerebral correlates of objects in

the environment have been mediated in part by the visual apparatus, in the case of the dog there will be relatively few such correlates for specific stationary objects as a result of visual stimulation. Consequently it is to be expected that disruption of coordinated cerebral activity will be less frequent with stationary objects, than with moving objects. Since visual learning plays such an important role in the genesis of spontaneous fears, the visual acuity of a species will determine largely the degree to which that species will be susceptible to fear of inanimate objects.

In the dog, since the olfactory sense is highly developed (2,25), it is likely that strange, unfamiliar smells give rise to a degree of avoidance behaviour that would place the dog above the horse in psychological complexity.

Although the dog's visual acuity is poor when compared to other mammals (2,12,25), it has been pointed out that motion of an object makes that object more discriminable from the rest of the field. McBride and Hebb (17) may not have considered this point, and thus they have stated that spontaneous fears of stationary objects seldom occur in the dog.

The present investigation, however, indicates that dogs manifest spontaneous fears of a wide variety

of innocuous objects, placing the dog well above the rat in complexity of emotional behaviour.

## SUMMARY AND CONCLUSIONS

Previous investigations of spontaneous fears have reported the avoidance behaviour by chimpanzees of a wide variety of innocuous objects. In the present study, home-reared dogs served as subjects to demonstrate the stimulus situations which produce spontaneous fears in the dog, and to gain information about the strength of these visually aroused fears. The past history of the dogs was known and they were tested in familiar surroundings so that it was reasonably certain that the fear produced by the test objects was not due to association with a more primitive cause of fear.

The conclusions may be stated as follows:

(1) Spontaneous fears in the dog can be visually aroused by a large number of innocuous objects.

(2) The number of avoidance responses made to moving test objects was, statistically, significantly greater than the responses made to the stationary test objects.

(3) Learning plays an important role both in the development of the spontaneous fear, and in the genesis of a particular type of response in a given stimulus situation.

(4) Spatial factors play an important role

in determining the type of emotion which is elicited. Dogs tend to avoid exciting large objects and attack exciting small objects.

(5) Temporal factors also contribute to the spontaneous fear of innocuous objects. The rate of motion of a test object effects the occurrance of the fear response.

(6) The spatial and temporal variables in a test situation, in order to provoke fear in an individual dog, must be supported by the factor of strangeness or unfimilarity of the test situation.

(7) In comparing the unlearned visually-aroused fears of the dog with those of other mammals, it was concluded that the dog is above the rat, but below the porpoise in complexity of emotional behaviour.

(8) It is dangerous to assume a hierarchy of psychological complexity without a knowledge of the degree of development of each of the senses, or without the consideration of phenomena which have attention-getting value for a species.

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