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HABITUATION OF THE THREATENING RESPONSE IN CATS AND KITTENS

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Abstract. Modifications of the threatening response occurring in cats and naive kittens were studied during repeated confrontations by a dog. Most of the kittens when confronted by a dog for the first time displayed a threatening response. There was a wide individual variation in the intensity of the first response. In some kittens initial sensitization occurred. With repetition of the confrontations the response waned. Complete habituation of the response in the kittens was achieved after 4 to 15 daily sessions, in adult cats it took from 2 to 47 sessions. In both kittens and adult cats various components of the threatening response habituated at a different rate. This caused the pattern of the response to change during repetitive confrontations. This "out of step" habituation of the components has been described with regard to the cardiovascular components of the response (8). It is concluded that the threatening reaction is subject to habituation and that the components of this response may be suppressed independently from the others, thus modifying the pattern of the response.

INTRODUCTION

It is now well established that the threatening behavior in birds and fishes may be habituated with repeated exposure to the stimulus (4, 6, 11, 12). It has been also observed that during the course of habituation of the threatening display in the fish various components of the response habituate at a different rate (4, 6). Habituation of the threa-

tening behavior in mammals has not been studied systematically. Habituation of the cardiovascular components of the threatening response has been described in cats and dogs (8, 13, 14). From these studies it was apparent that the cardiovascular and the behavioral aspects of the threatening reaction did not habituate simultaneously. In the present work an attempt is made to establish the habituation rate of the threatening display of adult cats and naive kittens confronted by a dog and to analyse the course of habituation of the components of the response.

MATERIAL AND METHODS

The experiments were carried out on seven kittens (3♀ and 4♂) and six adult cats (4♀ and 2♂). The kittens were born and brought up in a cage away from other animals, in a separate room so that they had experience only with their mothers and littermates. The light/dark cycle was natural. The experiments commenced when the kittens were 4–6 mo old. Preliminary habituation to the cage in which the kitten was to be confronted by a dog preceded the confrontation series. In addition all cats were habituated to handling by experimenter. Confrontation experiments on kittens and cats started as soon as it was obvious that they were familiar with the surrounding, walked around the cage, purring or sitting quietly and dosing. The adult cats were purchased from a dealer and their past experience with the dogs was not known. The adult cats were confronted while in their home cage. The cage stood on a low table, placing the cat at the dogs eye level. In confrontation experiments a non-aggressive, docile dog was brought on a leash by one experimenter within 1–2 inches of the cage in which the cat was placed. The same dog was used throughout each series of confrontations. The dog was taken on a leash to the cage containing the cat, usually sniffed around the cage, looked at the cat and walked away. The dog did not growl. No physical contact was allowed between the cat and the dog during the confrontation although they were able to sniff each other. The dog was taken out of the room and brought in again close to the cage with the cat. Each single confrontation lasted maximally 1 min and the interval between the confrontations was 1 min. This procedure was repeated ten times once a day. Each confrontation session lasted 15–20 min. The observer standing close to the cage scored the cat's threatening display against a list of following components of the response: 1. pupillary dilatation, 2. pricking up ears, 3. tail up, 4. piloerection, 5. back arching, 6. crouching, 7. growling, 8. hissing, 9. spitting, 10. pawing with extended claws, 11. springing towards the dog. All these components are present, when a full threatening reaction leading to an

attack is naturally elicited or by stimulation in specific defence areas of the amygdala, hypothalamus and the brain-stem. These scores were used to construct compound graphs indicating the number of components showing up in the responses during each session. The confrontation sessions were carried out daily apart from weekends on both kittens and adult cats. Habituation of the threatening reaction was considered complete when apart from pupillary dilatation and pricking up ears no other components appeared.

RESULTS

The response of naive kittens

During the first confrontation of the first session 6 out of 7 kittens displayed threatening response. There was a slight variation in the number of components comprising the first response as well as in the way in which the response was changed during the first session (Fig. 1). One kitten (No. 2) did not respond till the 6th confrontation of the first session. In the responding kittens the most frequently occurring components responses were pupillary dilatation, pricking the ears, piloerection and arching of the back. Vocalization (hissing and growling) occurred persistently in 3 kittens. With the repetition of the confrontations, the threatening reaction gradually diminished (Fig. 2). However, various components of this response habituated at a different rate. Figure 3 illustrates how piloerection, back arching and hissing behaved throughout the confrontations sessions in all kittens. Occurrence of all these components has shown considerable independence: the increase in score of all components in some instances was accompanied by decrease or no change in the others. Complete habituation was achieved in all kittens but there was great individual variation in the number of sessions required (range 4–15 sessions) (Fig. 2). The intensity of the initial response could not have been the most important factor influencing the rate of habituation, for instance the score of kittens No. 4 and 7 was the same during the first session but the time required for a complete habituation was very different in each of them (14 and 4 sessions respectively). Kitten No. 6, with the highest score in the first session, took 11 sessions to habituate completely, while kittens No. 1 and 3 with a slightly lower initial score took 15 and 14 sessions to habituate.

The response in adult cats

There was a great variation in the response of the adult cats (Fig. 4). During the first session one cat did not respond at all (cat 7) and two others responded at a very low level (cats 9 and 10, Fig. 4). Most cats

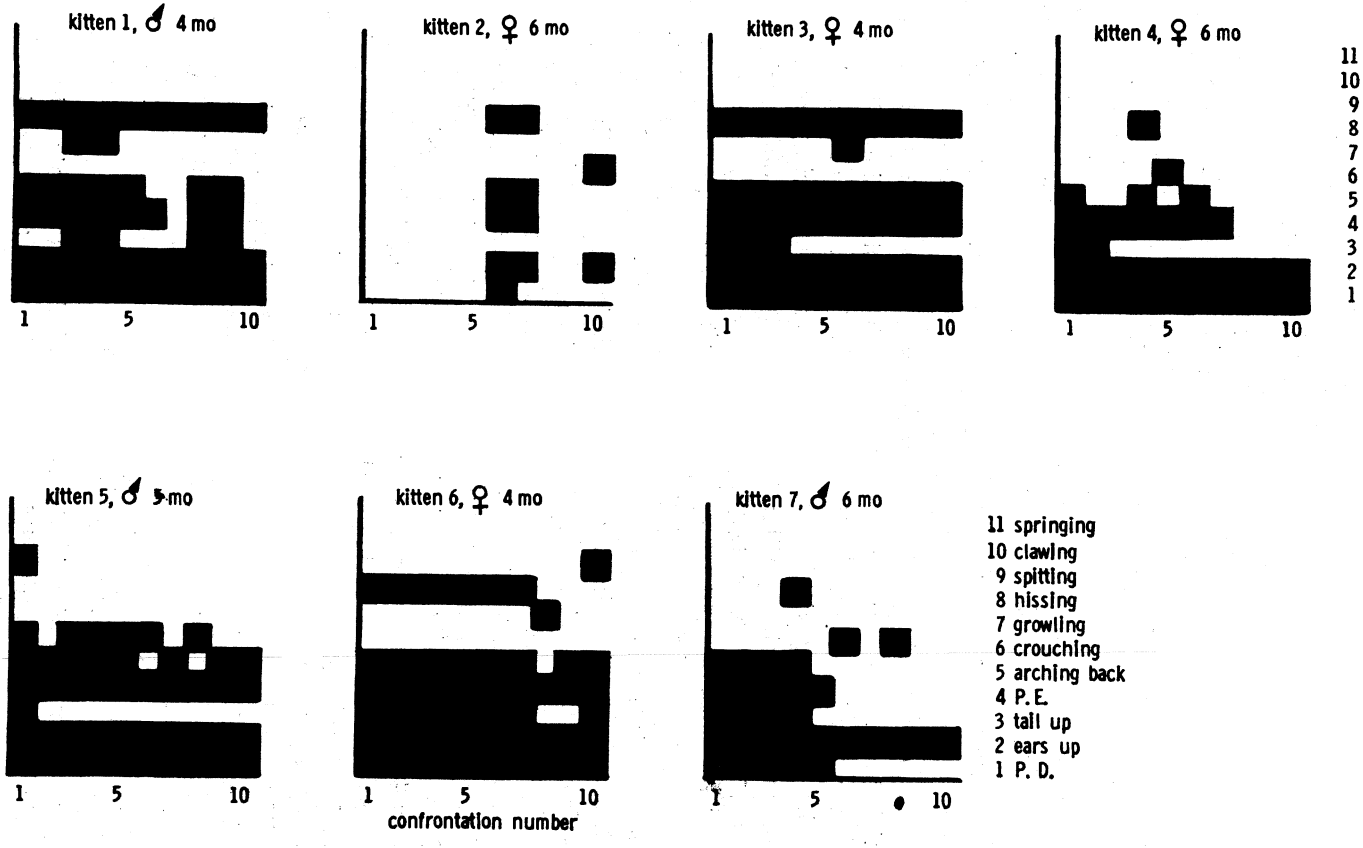

Fig. 1. A diagrammatic representation of the threatening display in all 7 kittens during the first confrontation session. The 10 confrontations are represented on the horizontal axis, the figures on the vertical axis indicate the components of the response. P. E., piloerection; P. D., pupillary dilatation.

(4 out of 6) showed an initial increment of responsiveness (sensitization), including the cat which initially did not respond at all (cat 7). Eventually the threatening reaction habituated during the course of repeated confrontations. The rate of habituation varied from 2 to 47 sessions. The habituation was complete in 3 cats, in 3 others, however, the response, although reduced, persisted till the very end. In one cat (No. 3) the confrontations were carried out for 47 sessions and this led only to a partial habituation (Fig. 4). The pattern of the threatening response varied from cat to cat and with repeated confrontations various components appeared and habituated independently (Fig. 5). It often happened as in kittens, that while one of the components was declining the other would maintain its high level of incidence or there could be simultaneous decrease of one and increase of the others (Fig. 5). There was no detectable regularity in the way the response was changing during repeated confrontations, it was therefore impossible to predict how long it would take to habituate any of the components of the threatening reaction.

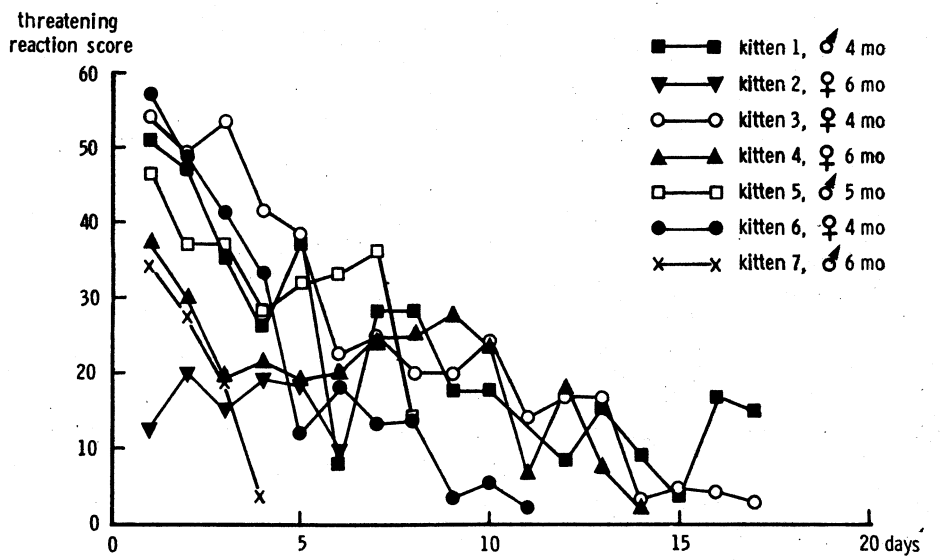

Fig. 2. Habituation curves of the threatening display in 7 naive kittens confronted by a dog. Each point represents the number of times the components of the response occurred during one session (i.e., 10 confrontations, maximum score of 110).

It was noticed on few occasions that cats sniffing at the dog would produce a sudden flaring up of the threatening response by simultaneous appearance of a greater number of components.

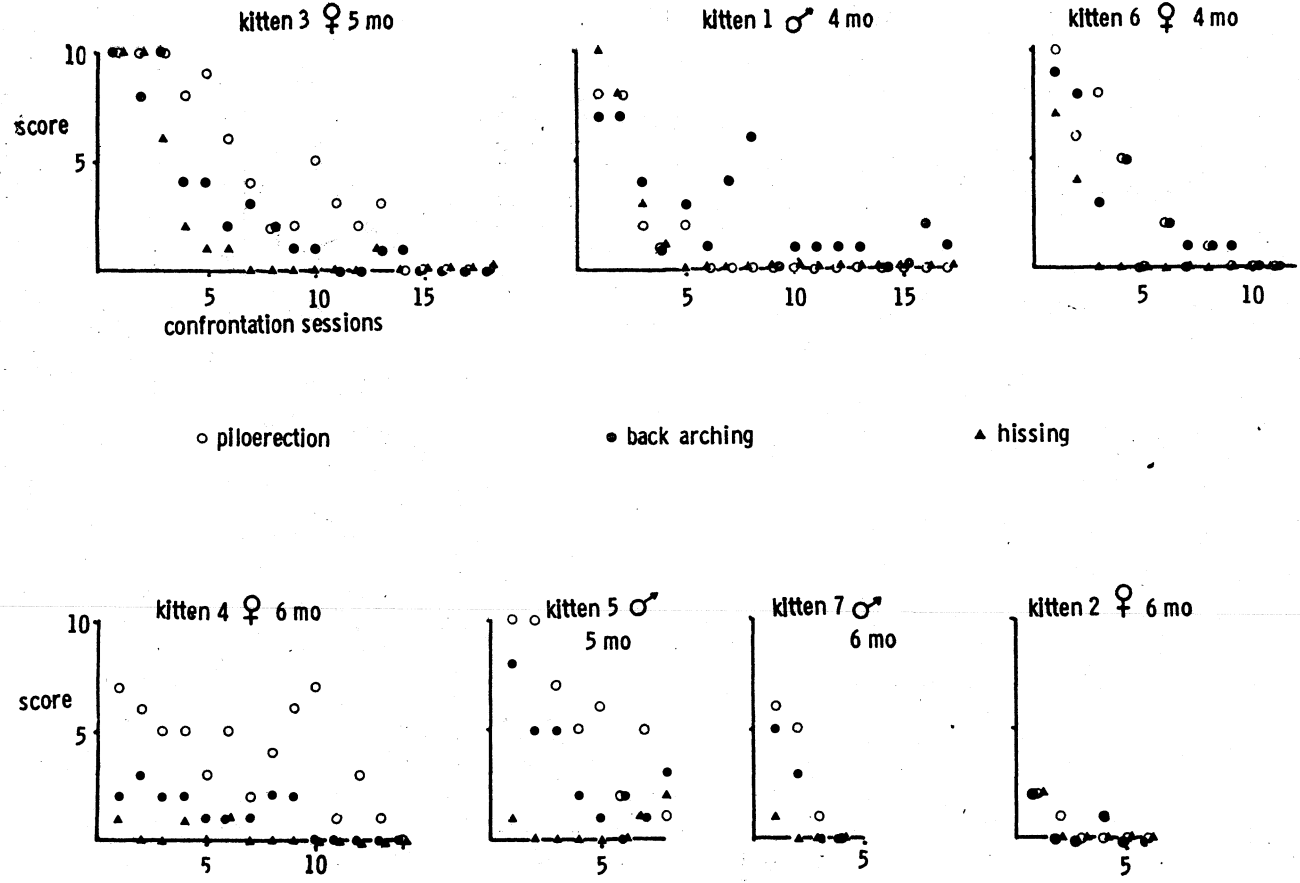

Fig. 3. Frequency of occurrence of piloerection, arching of the back and hissing in naive kitten during a series of confrontation sessions.

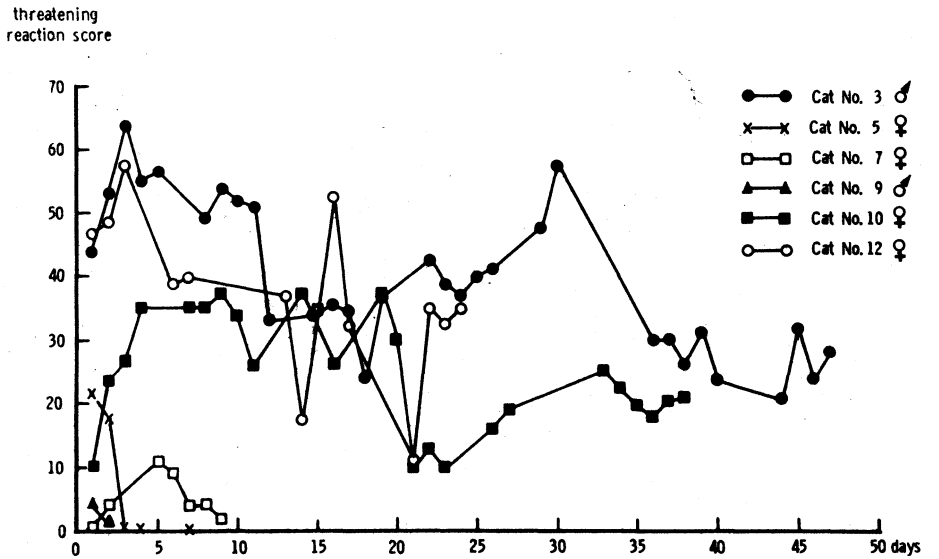

Fig. 4. Habituation curves of the threatening display in 6 adult cats. Scoring the same as in Fig. 2.

DISCUSSION

The data show that there is individual variability in the pattern and habituation rate of the threatening response of adult cats confronted by a dog. In order to assess whether the individual difference in responding to a dog in adult cats could have been essentially accounted for by previous experience, a series of confrontation experiments were carried out on naive kittens. However, it was found that the kittens also showed differences in the pattern of their threatening responses as well as in the rate of habituation. During habituation of the threatening response in kittens, the components of the response habituated independently as they did in the adult cats. This is in agreement with observations (4, 6) on fishes. Eventually, in most cases, habituation led to such a reduction of the threatening response that only an orienting response was left (pupillary dilatation and pricking up ears). Melzak (9) made similar observations on ducks, in which fear reaction was reduced to the orienting response after exposure to hawk models. Threatening behavior, fear and orienting reaction are therefore closely related responses, this inference is strengthened by the fact that the cardiovascular components of these responses have been shown to be identical (2, 3, 5, 13, 15).

During the process of habituation the pattern of the threatening

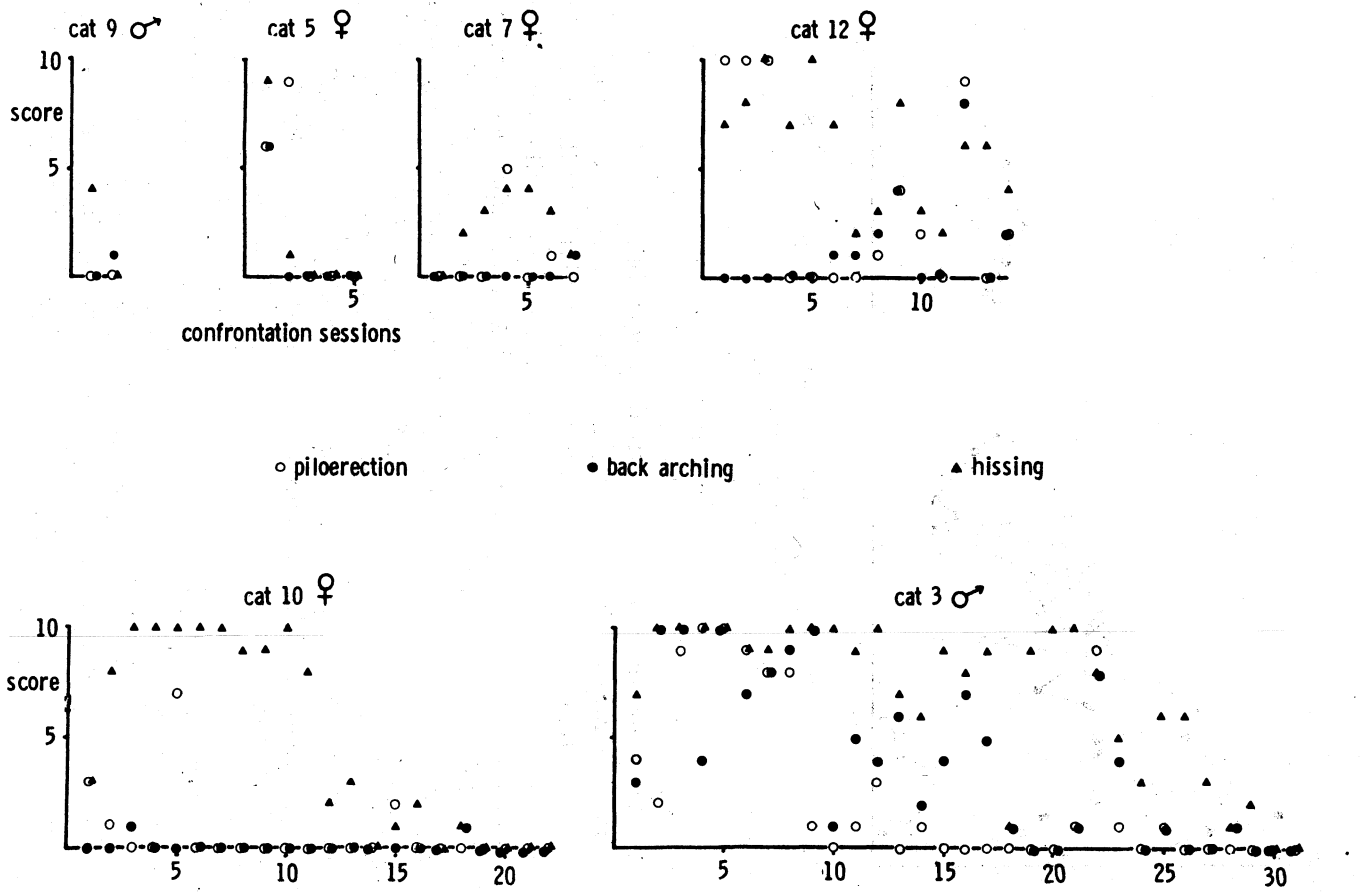

Fig. 5. Frequency of occurrence of piloerection, arching of the back and hissing in adult cats during habituation of the threatening response.

response is continuously changing by waning of the separate components at different stages. This dissociation applies also the cardiovascular components of the response (8, 14). It can therefore be stated that there is no set pattern of a "natural" threatening response in cats, the composition of it will depend on the stage of its habituation and on the individual responsiveness of the animal.

There is no doubt that the intensity (pattern) of the threatening response depends on the quality of the stimulus. The importance of "naturalness" of the stimulus has been stressed by Peeke (10) indicating that the threatening response of the three-spined stickleback to a model was weaker and habituated faster than to a live male.

In their classical paper on the defence reaction in cats elicited by electrical stimulation in the hypothalamus Hess and Brügger (7) compared the elicited reaction with the threatening display of a cat confronted by a dog. This comparison, however, has to be qualified as we now know that the naturally elicited threatening response varies in its composition. Only the most effective stimuli, which were not subjected to habituation, can evoke a "full" threatening display comprising all its behavioral and autonomic components. Furthermore it is apparent that the habituation process must exert its inhibitory effect on areas controlling single components of the threatening response but not on the hypothetical centre integrating the whole response (1). If the latter case was true all components would diminish their occurrence simultaneously.

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