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Wolf Socialization: A Study of Temperament in a Wild Social Species

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SYNOPSIS. A detailed analysis was made of the process by which the wolf comes from a state of unfamiliarity and fear of humans to a state of familiarity and friendliness. The nature of the process was found to depend on the age of the animal as well as the technique employed by the experimenter. Although young cubs were found to respond positively to almost any form of human contact, the older cubs and juveniles required much more time and effort to socialize, and fully matured adults offered very special problems which required specialized techniques to overcome. Periods beyond which no socialization could occur were not found. Wolves socialized as cubs had to be reinforced repeatedly in order to maintain their social bond with humans; however, adult wolves retained their socialized behavior even after being left with unsocialized animals and not handled for 18-22 months. Wolves socialized with the aid of tranquilizing drugs (chlorpromazine, librium, and reserpine) did not retain their socialization when the drugs were withdrawn on a variety of schedules. The development of fear responses as the animals grow older, and the association of fear with the unfamiliar, closely parallel the increasing difficulty of acquiring socialized behavior as well as the decreasing difficulty of retaining that behavior once it is acquired. Socialization is viewed as a conditioning process which must take place after the development and in the presence of the free expression of the subjective components of fear, a separable aspect of the general phenomenon of genetic wildness.

The evolution of social behavior and the mechanisms by means of which it develops and is maintained have become major areas of investigation not only for zoologists and naturalists, but also for psychologists interested in the formation of social bonds, and anthropologists interested in the biological origins of human group behavior. While many of the recent investigations have dealt largely with primates, those aspects of non-human primate behavior that may be considered as specialized and unique can only be identified in the context of comparative studies with social species in other mammalian groups. Among these, the wolf serves as an excellent example, being, as it is, a highly social species that has been studied in the wild (Murie, 1944; Crisler, 1958; Mech, 1966); under semi-natural conditions of confinement (Schenkel, 1948; Rabb, Ginsburg, and Andrews, 1962; Ginsburg, 1965, 1967; Rabb, Woolpy, and Ginsburg, 1967); and under conditions of domestication (Fentress, 1967).

The present study derives from our interest in genetic wildness and emotionality in relation to the formation of social bonds in mammals (Ginsburg and Allee, 1942; Ginsburg, 1949, 1958) and more directly from our 8-year study of the social organization of a captive wolf pack (Rabb, Ginsburg, and Andrews, 1962; Ginsburg, 1965, 1967; Rabb, Woolpy, and Ginsburg, 1967), supplemented by additional studies on the interactions of wolves and humans (Ginsburg, Woolpy, Kleiman, and Edwards, 1962). During the course of these studies we have analyzed the behavior of the wolf from the standpoint of the development and maintenance of social relationships between wolves and wolves, as well as between wolves and humans. We have called the process by which these wolf-human relationships develop, "socialization." It is most simply characterized by the change in the behavior which a human elicits from a wolf. The wolf comes from an unsocialized state of avoidance or negative response toward humans to a socialized state of approach and positive response towards them.

We have been primarily concerned with the effects of various experimental procedures on the process of a developing wolf-human social relationship. The socialization process has been studied in relation

to the behavioral ontogeny of the wolf. By subjecting wolves to human handling before, during, and after the manifestation of the autonomic and skeletal motor responses associated with the expression of fear, we have attempted to test and elucidate the hypothesis that the principal obstacle to the acquisition of positive social responses to humans is the wolf's fear of the experimenter; and that this fear, with its attendant emotionality and avoidance, is a separable and essential aspect of the general phenomenon of genetic wildness (Ginsburg, 1965, 1967).

Both the acquisition and retention of positive social behavior towards humans have been tested at various ages before and after the development of overt fear responses in order to determine if the onset of fear had any pervasive disruptive effects on previously acquired socialization. In addition, we have attempted to block or reduce fear by means of tranquilizing drugs and to condition wolves to human handling under tranquilization as well as without the aid of drugs.

The present report is based on seven wolves with various histories of socialization to humans. Three were exposed to human handling continuously from birth. Three others were handled during the infant and juvenile periods and subsequently placed with unhandled animals for 18 to 22 months, and one had had no direct human contact until she was approximately five years old.

Animals that were deprived of direct human contact were maintained with or without other wolves in indoor-outdoor runs which were cleaned manually every day. They were fed meat placed on the floor of the run by hand. In two instances the deprived animals were maintained at the zoo. Animals on a handling schedule were housed and fed in the same manner as the deprived animals.

The socialization procedure was designed to offer the wolf the maximum possible latitude of response to the experimenter while at the same time permitting the investigator to employ a variety of techniques. After acclimatization to laboratory surroundings, including the presence of the experimenter outside the pen, the experimental animal was confined to the inside portion of his run (4′ × 8′) for several hours prior to the handling session, as well as during the period of handling. An animal was judged to be acclimatized when it moved freely about its run and showed no obvious autonomic signs (salivation, piloerection, urination, defecation, pupillary dilation, and trembling) or postural attitudes associated with fear while the experimenter was present in the room outside the run. The investigator would then enter the run, seat himself on the floor against the partition dividing the run from the room, and remain there quietly. The autonomic and postural signs would again be evoked. When the animal became habituated to the presence of the experimenter just inside the pen, these signs again subsided, and the investigator would then begin to move his body, maintaining a sitting position, reach out with his hand, and finally, after a period of weeks or months, initiate physical contact. At each new phase the autonomic and postural signs described would again appear to varying degrees, and the wolf would be judged to be ready for the next phase when these signs again abated (see description of procedure in Ginsburg, 1965, pp. 61-65).

Observations of the wolves' behavior during the socialization sessions were independently recorded by the experimenter and another member of the research team. Film records for later analysis were made on a sampling basis.

In wolf cubs born in captivity, the first sign of the development of fear is cautiousness in approach on initial contact with a person or strange object. This behavior is exhibited by the sixth or seventh week of life. Prior to this time, the cubs tend to approach anyone readily, or at least not to move away from them. Their approaches are characterized by tail-wagging, nosing, licking, and biting, and are noticeably variable among littermates. Subsequent to the first overt signs of fear, it becomes pro-

gressively more time-consuming to obtain a positive response from a cub on initial contact. By the end of the eighth week such responses usually are not elicited in a single session unless it is unusually prolonged. Toward the end of the third month the fear responses are developed to the point where strange objects, loud noises, or strange people usually elicit urination, defecation, salivation, crouching, piloerection, pupillary dilation, tail-tucking, trembling, and a laying back of the ears (for descriptions of characteristic postural attitudes of the wolf, see Schenkel, 1948). From this time on, socialization of previously unsocialized cubs requires considerable time and effort. At six months the process of socialization takes still longer to achieve, while the fully adult animal requires even longer to become socialized to human handling.

Wolves are highly social in nature (Murie, 1944; Crisler, 1958; Mech, 1966), as well as under conditions of confinement when in groups (Rabb, Ginsburg, and Andrews, 1962; also Rabb, *et al*, this volume). Once socialized, they are extremely gregarious to humans and exhibit all of the attitudes and mannerisms of a very friendly dog, as well as some of those seen in most wolves, but not usually observed in dogs. These include attempts to hold the investigator with their paws, and a mouthing of the chin and lower face area (Fig. 1).

Socialization in the adult wolf under the conditions obtaining in our laboratory takes place in four gradual but definable stages: escape, avoidance, approach-aggression, and finally the friendly or socialized state.

During the initial phase of socialization, the unsocialized adult wolf, that has become acclimated to its surroundings and to the experimenter's presence outside the pen, becomes highly emotional when the experimenter enters the run. Such an animal usually attempts various escape maneuvers, including digging at the concrete floor, pawing at the closed doors, and jumping high into the air. As the wolf becomes somewhat more acclimated, this behavior alternates with an extreme retreat in which the wolf crouches in the corner of the run farthest from the observer with his tail tucked between his legs and his ears back, panting, trembling, and salivating. This extremely fearful behavior is accompanied by frequent defecation and urination, trembling, and changes in pupillary diameter. This first stage is called the *escape stage* of the socialization process.

FIG. 1. Muzzle-bite greeting by socialized wolf.

Depending on the age and previous experience of the wolf, the second or avoidance stage will be exhibited approximately a month after the handling sessions begin. This stage differentiates slowly out of the escape phase. The intensity of the emotionality as judged by the autonomic signs begins to abate, and the wolf's attempts at active escape are less frequent. Now he simply stays as far away from the experimenter as he can. However, instead of crouching and trembling in the corner, the wolf will sit in a more relaxed manner and

may untuck his tail from between his legs and point his ears straight up and toward the experimenter. Should the experimenter increase his own bodily movements during the early phases of his second stage, the wolf may revert to previous emotionalitiy and escape behavior. Usually, after several months the wolf consistently permits the experimenter's approach, and it is at this stage that the handling may begin. As socialization progresses, the wolf makes incipient movements toward the experimenter, which can be stopped if the experimenter shifts his eyes and looks directly at the wolf.

Soon afterwards the *approach stage* begins. This represents a critical and delicate stage of the socialization process. The wolf is at first investigative and highly alert. He will sniff timidly at the experimenter's body and clothing, but will retreat if the experimenter moves or looks directly at him. Later, during the approach stage, he will attempt to chew and pull the experimenter's clothing, and will rub in the area where the experimenter was sitting, as soon as the latter has left the run. Occasionally he will also mark this area with urine. He will next rub against the experimenter himself, and occasionally micturate directly on him (a pattern of behavior more often exhibited in coyotes than in wolves). While rubbing against the handler, he will often allow himself to be petted without retreating.

As the wolf's familiarity with the experimenter increases, he begins to take more liberties. This is enhanced if protective clothing is worn under the usual laboratory coat or coveralls. The wolf may attack such devices as though they were not a part of the investigator. Generally, the biting and tugging is directed at the handler's clothing. If one tries to prevent this, the wolf may bite harder and snap more vigorously. Attempts to dominate the animal physically at this stage may either lead to a full blown attack or may provide a setback to an earlier stage of socialization that is then more difficult to overcome than the first time it was encountered. In practice, we have found that it is best to suppress one's physical movements when under mild attack. Invariably the animals retreat if a second member of the team approaches or enters the run. The handler is, therefore, in no real danger.

As it is difficult to keep the wolf approaching and at the same time prevent him from biting, the experimenter attempts to change the oral investigative behavior of the wolf into something more acceptable by petting and scratching him. Fortunately, the wolf will threaten when he is antagonized, and thus give ample warning of his intention. Usually the threat is ambivalent, consisting of a slight curl of the upper lip which just exposes the teeth. This may be accompanied by a low growl. The ears are in a natural upright position or slanted slightly out to the side, and the tail is in the normal position—down and slightly out. At this point the experimenter must inhibit the aggression to the point where the threat is withdrawn and the posture of the wolf returns to near normal. If he is not successful in this attempt, he must rely on the approach of a colleague in order to make the wolf withdraw, or he must leave the run before the threat turns to attack. If he frightens the wolf, the socialization process may have to be considerably extended. If he does not sufficiently inhibit the wolf, he may sustain a vigorous attack. If his retreat is too hasty, the wolf is more inclined to be aggressive during the next encounter. Careful teamwork on the part of the experimenters generally keeps these problems to a minimum.

The fourth and final stage of socialization, during which the wolf becomes friendly, is exhibited when the experimenter is successful in preventing the wolf's aggression without inhibiting his approach. At this stage the wolf is no longer fearful of the experimenter, approaching him readily and assuming postural attitudes that invite scratching and rubbing. During this phase it is likely that the wolf will begin to lick the experimenter's hands and face. Still

later he will begin to wag his tail when the experimenter enters the room and will put his front feet up on the door of the run in anticipation of the experimenter's entry. The tail-wagging becomes more vigorous as the experimenter approaches the run. At this point, some six or seven months after the initial contact, the typical wolf may be considered socialized. This is also the stage at which the wolf will attempt to hold the experimenter with his paws and to greet him by placing his jaws around the chin and lower face in much the same way that he would place his mouth around the muzzle of another wolf in a wolf-wolf greeting ceremony.

Socialized behavior of the friendly sort is easily acquired by wolves socialized as young cubs and somewhat less readily by juveniles. In several instances where such socialized young wolves have then been isolated from further handling for extended periods (over 6 months) the socialization was not retained. It appears, therefore, that in the young wolf this social behavior must continue to be reinforced in order to prevent the fear responses from setting in. However, wolves exhibiting fully socialized behavior as adults have not been observed to revert, even after periods exceeding a year during which they had no direct human handling. These fully socialized animals retain their friendly behavior and generalize it to all humans who act appropriately toward them. We have never observed the one-mannishness so frequently seen in domestic dogs in any of our seven socialized wolves, and we attribute this to the extreme gregariousness of the wolf and to his ability to generalize, a quality which is differentially developed in the many varieties of domestic dogs. The necessity of having to confine wolves in a small number of runs in our laboratory has provided a physical situation in which it was easily shown that in contrast to the ability of adult wolves to generalize their human socialization to all humans that act appropriately towards them, they do *not* generalize their wolf socialization to all wolves. Each new wolf-wolf relationship, which develops among cage-mates, requires a few weeks of intensified social interaction, including fighting, to become established. However, once it is established it remains so throughout periods of separation of at least one year. These permanent relationships have not been observed among animals younger than one year.

So far as the socialization procedure is concerned, handling sessions lasting 10-20 min were found to be as effective as those lasting for an hour or more. Intersession intervals of three days were as effective as daily sessions, and once the extreme reactions of fear had been overcome, occasional intervals lasting several weeks were found to stimulate the wolf to approach more readily. Socialization sessions were not as effective when there was more than one wolf in the run, even if the second wolf was fully socialized. Under these conditions the less-socialized wolf would often use the other as a barrier behind which he could retreat and from which he could mount aggressive attacks.

As mentioned earlier, a wolf socialized while very young must be reinforced in this socialization if it is to persist, whereas one socialized over the same period of time into adulthood will retain the socialization over a considerable period in which it is not reinforced. However, those wolves that have been socialized early and have been so handled as to retain their socialization appear to be more intense in their positive social responses than the others.

Because of the critical role of the extreme wariness of a wild animal in the process of socialization—a behavior that manifests itself as an extremely low threshold of response to any environmental novelty, as well as an intense and emotional response of long duration to such novelty, we have attempted to socialize wolves using librium (methaminodiazepoxide), reserpine (3,4,5-trimethoxybenzoyl methyl reserpate), and chlorpromazine (2-chlor-10-[3-dimethylaminopropyl] phenothiazine). Doses were first screened on dogs of comparable body weight and were regulated to be just subataxic on this basis. Doses were individual-

ly prepared according to the body weight of each experimental animal and were placed in capsules which were administered orally, usually disguised in small pieces of meat. A variety of dosages and dosage-intervals were used, and experiments during which the investigators were aware of the procedures were alternated with experiments in which some of the observers did not know which, if any, of the animals had been drugged.

The lowest dosage levels at which behavioral effects of previously untreated wolves were noted were: librium, 5 mg/kg; chlorpromazine, 5 mg/kg; and reserpine, 0.08 mg/kg. Despite the fact that the drugs in question are presumed to have different modes of action, their major behavioral effects are comparable. At these dosage levels the partially socialized wolf increased his frequency of approach to the experimenter and permitted the latter to approach without trying to walk away. This effect lasted from about the fourth through the eighth hours, with the peak effects observable at approximately 6 hours after oral administration.

The major effect of these tranquilizers on unsocialized and partially socialized wolves was a temporal compression of many of the behaviors characterizing the first three stages of socialization, so that the entire process up to this point occurred over a period of approximately 4 days instead of several months. During the approach phase the animals were more aggressive than were those that were drug-free. The drugs also seemed to repress the threat postures which normally forewarn the experimenter of an impending attack. Thus, the tranquilized wolf may appear to be more aggressive than his control, depending on the time after administration of the dose, during which he is tested (varying around the twelfth hour after administration). Both short-term and long-term tranquilization have thus far produced no lasting behavioral effects after the drugs are withdrawn. Fully socialized wolves are not markedly affected by the drugs in their social responses. When the tranquilizers mentioned were administered as a single unrepeated oral dose (at the lowest effective levels) the wolves exhibited a lower threshold for aggression over approximately two days. Fifty percent greater doses produced the same effects for slightly longer periods of time and were accompanied, as may be expected, by increased side effects which included sedation and varying degrees of ataxia. At present we are testing the effect of daily doses of librium over a prolonged period (8 months at this writing) and have found that the amount of drug necessary to produce any noticeable effect is over three times that which is effective as a single dose in an unhabituated animal (15 mg/kg). Furthermore, on none of the regimens of daily dosage have we found any cycling of behavior. The wolf is simply more likely to approach the experimenter at any time. Also, at this dose there have been very few incidents of aggression.

The approach responses exhibited under tranquilization do not involve the tail-wagging, mouthing, and other expressions seen in fully socialized control animals. The wolves seem to be brought to the somewhat ambivalent approach stage consequent upon the reduction of fear, and maintained there—depending on the dose and interval of drug administration used. Thus far we have not been able to bring any animal to the fully socialized stage under drug or to maintain it at the most positive approach stage achieved under drug after the drug has been withdrawn, regardless of the variations in the tapering-off process. The tranquilizers somewhat mimic the transition from avoidance to approach stages in control animals (it should be noted that in all of these experiments each animal served as its own control), thereby lending credence to the idea that loss of fear is the essential step in the process of socialization. Furthermore, since the drug does not affect the social behavior of the socialized wolf, it does not by itself induce approach or aggression, but it reduces fear. In so doing, it prevents an animal that has still not been positively socialized from having his subjective fear responses conditioned. Thus, blocking of fear is not conducive to socialization.

SUMMARY

Fundamentally, the wolf is a social animal, having the capacity to form lasting social relationships and to live in rather exclusive packs with 10 or 20 of his own kind. Generally, these relationships are formed very early in life and nurtured by constant wolf-wolf contact throughout at least the first year. Consistent with the exclusivity of the pack is the fact that new social relationships are formed with difficulty, whether these are between wolf and wolf or between wolf and human. The exclusivity and solidity of the pack are maintained in part by the mechanism of fear of the unfamiliar, which is characteristic of wildness. This fear can be reduced chemically, but such reduction does not by itself induce the formation of lasting social relationships. These must be formed over a long period if they are to be lasting, and one aspect of their formation appears to be coping with the unreduced subjective fear response. While this response develops during the first three months, social relationships do not become permanently bonded for a much longer time. The subjective affective component of the fear response which is associated with the unfamiliar, appears to continue to develop over the entire first year. The socalization experiments both with and without the use of tranquilizing drugs, as interpreted in the context of the development of wolf-wolf relationships between individuals in a captive pack, lead us to conclude that permanent socialization is achieved only by the conditioning, through experience, of the subjective aspects of the fear response. Socialization is possible at any age, provided that the affective components of fear can be brought under control, either by means of artificial conditioning such as the kind we have described, or by means of its natural equivalent—continued experience in a wolf pack.

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