

Observations on the Behavioral Development of a Hand-Reared Male Timber Wolf

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SYNOPSIS. Observations on the behavioral development of a male timber wolf, hand-reared from the age of four weeks, have been continued for a period of three years. Data include the following: (1) Adjustment to human companionship has been successful even after sexual maturity. (2) Behavior towards strange persons and objects is cautious. (3) The animal remains more independent and aloof to persons than similarly reared dogs. (4) Interaction with dogs, including males and young puppies, is marked by gregariousness and lack of aggression. (5) Small domestic species have been attacked occasionally, the response depending largely upon the behavior of these animals. (6) Large species are avoided, chased, or ignored. (7) Numerous motor patterns, postures, and communicative signals are closely similar to siblings and other wolves and contrast with dog companions. (8) Sharp behavioral changes occurred at eight and 12 weeks, the former initiating aggressive tendencies, the latter extreme avoidance in the presence of new objects. Restlessness, then calming, followed in later months, and slight seasonal fluctuations have been noted. (9) Rudiments of many adult motor patterns occurred at an early age, e.g., small prey-pounces and pelvic thrusts seen by eight weeks. (10) Vocalizations include a wide repertoire of howls, squeaks, growls, and barks.

The wolf is one of the most fascinating and little understood mammals in the wild fauna. To the behavioral scientist he provides a particularly exciting challenge. The mythology and informal accounts of his activities whet the appetite, but when one turns toward hard-core observations there is a paucity of data (*cf.* Murie, 1944; Young and Goldman, 1944; Crisler, 1959; Pimlott, 1961). The present study derived from a desire to obtain a more intimate knowledge of the wolf and its ability to adjust to man. This interest was precipitated by the observations of Kramer (1961) in which an attempt to maintain close contact with a male European wolf resulted in the animal having to be shot at the age of 10 months. Further observations were obviously necessary. Other reports (*e.g.*, Murie, 1944; Crisler, 1959; Heimbürger, 1961; Ginsburg, 1965) suggested that "socialization" might be possible, but differences in rearing conditions and discrepancy in reported success precluded precise prediction.

Socialization is not the only aspect of behavioral development particularly accessible under conditions of hand-rearing. Equally important to the understanding of underlying mechanisms is the close observation of behavioral sequences and their context that hand-rearing permits. Basic

questions such as the flexibility versus stability of different behavioral components can be approached in this manner. This is an essential step toward an understanding of how information or instructions contributing to adaptive responses of the species are stored and integrated.

There is reason to suspect that relatively simple components of behavior remain essentially fixed for a given species although the animals are reared under variable conditions (Lorenz, 1961). Thus Schenkel's (1948) careful observations on expressive movements and postures of zoo wolves can probably be safely assumed to represent activities as they normally occur in the wild. It was beyond the scope of Schenkel's study to investigate the development of basic motor sequences plus the motivational variables affecting their elicitation and patterning, but it appears very likely that the close observations made possible by hand-rearing can suggest processes also relevant to these aspects of the species' normal adjustment to its environment.

The more variable the response or behavioral system under investigation, the more careful one must obviously be in making generalizations, particularly from an individual animal. However, it must be recognized that two classes of data retain their

essential utility: (a) every observation represents a functional relation or product that *can* occur; (b) every result not seen indicates that this end product *need not necessarily* occur. Such questions, in themselves, are of no little interest in the understanding of the wolf and its behavior.

METHOD

A male timber wolf (*Canis lupus*) of Canadian stock was obtained from the Zoological Society of London's Whipsnade wolf wood on May 28, 1963. At that time the animal was approximately four weeks old. He weighed 3.2 kg, measured 21.0 cm high at the shoulders and 49.0 cm from tip of nose to base of tail. His nose was short (4.0 cm) as were his ears (4.5 cm) which flopped rather than standing erect. The tail measured 16.5 cm and was nearly devoid of fur. The eyes, 2.5 cm apart, were a deep blue. Figure 1 shows the animal two days after it was obtained.

Close contact with Lupey, as he was named, was emphasized from the beginning. This included hand feeding, frequent walks and playful attention, and having him stay in my room at night. Contact with numerous other persons and animals was also encouraged. He was moved to an outside shelter at the age of 12 weeks, and has since spent most of his time in a similar arrangement. Four major changes in residence have been made: one at the age of 6 weeks, one at 11 weeks, and two after the animal was 1¾ years of age.

The main technique in rearing this wolf might be described as "firm cooperation." The emphasis has been upon persuading him to accept flexible goals rather than more strict attempts to express clear dominance. This fact is mentioned for it may have been important to establishing successful interactions between Lupey and not only myself but other persons, and contrasts with the technique apparently employed by Kramer (1961). Other observations support the suggestion that patience and relaxed contact are important for successful socialization (Crisler, 1959; Heimburger, 1961; Ginsburg, 1965; Lorenz, personal communication).

Extensive notes on each phase of the wolf's development have been taken. These have been accompanied by numerous still photographs and approximately 3,000 feet of Kodachrome motion film. During the first one and one-half years, comparisons were made with siblings at the Regent's Park Zoological Gardens, London. Comparisons with dogs have also been made. A short film covering the highlights of his first three years of life has now been completed. The present report summarizes some of the main data of this period. The study, which has been pursued during the course of related behavioral research, is being continued.

CHRONOLOGICAL SKETCH OF DEVELOPMENT

The division of development into sharp periods is somewhat arbitrary. The outline below is based upon convenience and emphasizes early developmental stages. Changes were most rapid during these early periods, and provided the framework from which subsequent patterns emerged. Available space precludes more detailed examinations.

Clearest alterations in general behavior were at the following times: (a) during the first 24 hours after the wolf was obtained, avoidance of people being supplemented by approach; (b) at 8 weeks of age, the wolf becoming both more aggressive and active; (c) at 12 weeks of age, restlessness becoming very pronounced; (d) at 20 weeks of age, strange persons and objects being treated with extreme caution. Less pronounced trends have occurred subsequently, the basic pattern being gradual fluctuations toward a more calm disposition. (See Scott and Fuller, 1965, for comparison with dogs.)

Age 4-6 Weeks (First Two Weeks After Acquisition)

After obtaining Lupey from Whipsnade, he was immediately driven to the author's dwellings in Cambridge. During the trip he was at first restless, but soon slept. Upon being released in the kitchen he immediately proceeded toward a dark corner. If

small objects were placed in his way, he would either push them or go over them. Alternation between cautious exploration and retreat followed within several moments. Behavioral changes were extremely rapid. People who remained still would be approached, but even slight movements would elicit avoidance reactions. During the first night the animal howled frequently. The howl was usually preceded by short whines and nodding of the head. During the howls the head would be lifted, eyes closed, and rear legs buckled slightly (Fig. 1). Howling could be stopped by picking up the animal and placing him in the bed, where he soon crawled up against the pillow.

The wolf had to be force-fed on beef soup and 1:1 diluted cow's milk for his first two days. After that he would initiate the feeding by whimpering and/or pawing. His initial reaction to new foods was cautious. For example, on his third day from the zoo he was given some warmed ground beef. The first bite had to be force-fed. The second bite was taken gently from my fingers. Lupey then shook his head and growled slightly. The third bite was snapped with three bites in quick succession before my hand could be removed. If the ground beef was then placed upon the floor, the wolf would often pounce in its general direction (Fig. 2), but orientation was poor.

After his second day at Cambridge Lupey had very little fear of people, and indeed would often go to considerable effort to be with them. A favorite game that developed within the second day, when the animal was taken to an outside garden, was to run back and forth between one person and another. A light lead was placed around the animal's neck so that he would be accustomed to restraint. As the animal began to explore more he would often grab objects in his jaws, shake his head, growl, and back-peddle. He would play with persons in a similar way. When he grasped skin his jaws closed less tightly than when he grasped clothing. Pawing with the fore-feet was common.

The wolf's gait grew notably more steady during the first week that I had him. He

would explore increasing distances, but continued to return to familiar surroundings at short intervals. Strange objects placed in these surroundings produced initial avoidance, then were investigated. Once he became familiar with one room in the house, placing him in a different room would cause initial cowering, then rapid exploration. Food would be ignored during these periods, but upon being returned to a familiar room feeding was enhanced. Quick transitions between behaviors continued throughout this period (*e.g.*, sleep—stand—howl—eat, all within 20 sec).

Age 6-10 Weeks (Move to Attic)

On June 9, at the age of 6 weeks, Lupey and I moved to an attic in the flat of Dr. and Mrs. R. Prescott. Lupey explored the room vigorously, but settled within an hour. The first evening was extremely hot, and the wolf staggered noticeably on several occasions. He was held out the window to revive. No further difficulty with this occurred.

The animal's motor coordination improved markedly during this period. Transitions between activities remained rapid. Tail-wagging became more common and preceded many acts. Pelvic thrusts were seen by 8 weeks, often accompanying clasping in play. By the age of 10 weeks he exhibited much digging and chewing. He also climbed over large objects, often by pressing his back and neck against available supports. He would push small objects out of his way. These were often carried in his mouth. A particularly interesting observation occurred when he was given a mop during this period. He grabbed the mop suddenly, shook it, and held it very tight, growling menacingly when anyone approached. It was difficult to take from him, and he remained agitated for several minutes. Wastebasket contents also became extremely attractive to Lupey during this period. He showed much persistence in trying to get to them, and would often snap if restrained. Books, furniture, etc., were chewed.

On walks Lupey showed his first interest

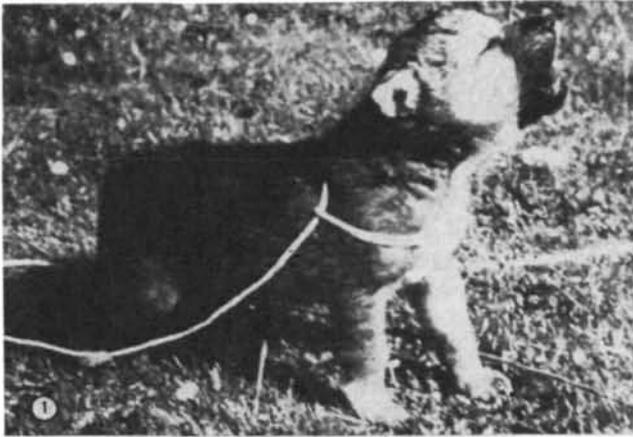


FIG. 1. Howling at age 4 weeks, two days after the cub was obtained. Compare posture to Figure 12.
 FIG. 2. Pounce at age 8 weeks. Basic movement was well formed but orientation poor.
 FIG. 3. Chasing geese at age 10 weeks. At this stage chases were short and playful.
 FIG. 4. A chicken killed at age 13 weeks is tied briefly to the wolf. The cat, which was not mo-

lest at this stage, was attacked when Lupey reached 6 months.
 FIG. 5. Investigating a horse at age 15 weeks. The wolf was at first hesitant but grew more bold.
 FIG. 6. Lupey, held by Dr. Prescott, gently paws young pup toward himself, accompanied by squeaking. Age 20 weeks.



FIG. 7. Begging posture to elicit play from wolfhound. Compare with Figure 9. Age 8 months.
 FIG. 8. Running with wolfhound in garden. Age 7 months.
 FIG. 9. Rolling on odoriferous object. Sides of neck are rubbed in alternating sequence. Age over one year.
 FIG. 10. Urination during second year. Leg-lifting had occurred but only occasionally and in un-

familiar setting.
 FIG. 11. Bucket game with Mrs. L'Angellier in garden. Age 7 months.
 FIG. 12. "Wolfgang." Howling to author's clarinet. Compare posture at 7 months to Figure 1.
 FIG. 13. With Coates family after move from Cambridge, England, to Rochester, New York. Age 2 years.

in dog scent posts at about 8 weeks. When released from his lead he would often break into zigzagging runs so sharp that his balance might be lost. His speed was sufficiently slow that he could be caught easily. He would occasionally come to call, but this response was variable. When taken for a run at Madingley Field Station, he fled from sheep if they approached, but would give brief chase if they ran from him. He showed only moderate interest in caged birds and rodents.

Upon returning from walks he would often give two or three whispered barks. Howls continued when he was left alone, particularly when voices could be heard in the house. He was at first extremely cautious of the stairs, but by 9 weeks could navigate them quickly. It became difficult to get out the door without him pursuing. Very persistent scratching at the door followed. This motor pattern, but expressed on various objects, was often observed if the animal had been disciplined.

By 8 weeks Lupey played vigorously and would grasp moving objects (such as socks or trousers being put on in the morning). Occasionally he would bite hard on one's hand and growl. Pinching his cheeks or placing one of his feet in his mouth was commonly employed to counteract this. He often became extremely excited at this

stage, at which times motor control was poor. On one occasion, for example, he drew blood grasping a piece of meat that was handed to him. He would also lick not only myself but visitors. This was very common following any bite. Indeed, he would occasionally grab one's hand in his jaws and lick at the same time. A combination of growls and squeaks also occurred (Fig. 17). He approached strangers but with somewhat more caution than previously. Persons he had met before were greeted enthusiastically, even if they had not seen him for several weeks. The typical pattern consisted of many high squeaks, much tail-wagging, slightly lowered haunches accompanying approach, pawing, licking, and rolling on his back.

This period ended with Lupey becoming increasingly more restless and destructive when confined to the room. On one occasion when I was away he apparently wedged himself between the wall and desk, and climbed up to the attic window. He then proceeded along the roof until he reached a neighbor's window, went inside, but returned to his room before I had come home. The story became available when the neighbor complained about dog footprints in her attic. A more suitable housing arrangement was sought.

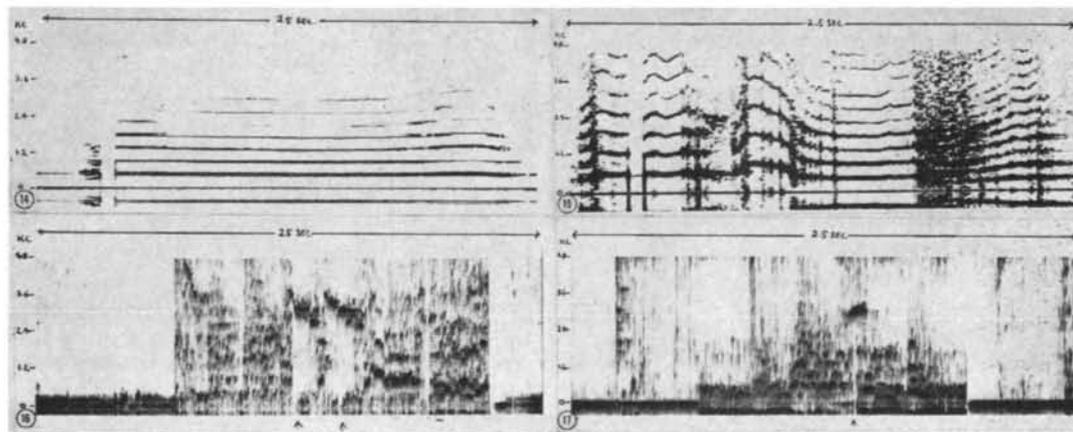


FIG. 14. Long-low adult howl. Note inflection at end. Filtered at 45 cycles.

FIG. 15. Short howl followed by abbreviated inflection. Filtered at 45 cycles.

FIG. 16. A pair of squeaks elicited during greet-

ing. Filtered at 300 cycles.

FIG. 17. Growl interspersed with brief squeak. Note momentary break in growl at peak of squeak, plus overlap. Food dish had been removed by author. Filtered at 300 cycles.

Age 10-26 Weeks (Move to Farm)

On July 17, 1963, Lupey and I moved to the L'Angellier's farm in Coton, Cambridge. He had previously been taken to the farm for two short visits. For ten days after arrival he was kept in the house except for walks. He shortly became extremely restless and destructive when confined, however. For example, he would often scratch at the door for many minutes, and growl plus snap if restrained. Therefore a shelter was made for him outside, to which he was attached with a 6 m chain. He was walked for approximately 1 hr daily, and visited very frequently. In addition, the seven farm dogs (including labradors, terriers, spaniels, and wolfhounds) were kept with him during the day (usually two or three at a time). Cats and chickens occasionally came into the yard where he was kept.

Moving outside proved very successful in calming the wolf. He spent much time investigating. For the first time he was seen to roll and rub his neck on odoriferous objects such as old bones (Fig. 9). He did much digging, and occasionally would scrape the ground with his forepaws before lying down. His initial response to both dogs and cats was submissive approach. Chickens and geese were approached more confidently, and would be chased for brief periods if they fled (Fig. 3). Horses were initially avoided. The wolf's locomotor skills improved markedly during the early part of this period. By 12 weeks of age he had developed an ability to circle or head off animals and persons in play.

Before the end of July (13 weeks) he caught but released two chickens that entered his yard. Upon attempts to reprimand him he snapped and growled. On July 30 he killed a chicken. I was away at the time, and it was removed only with considerable difficulty by Mrs. L'Angellier. He continued to snap at her for several hours. The bird was tied to his chain and covered with mustard (Fig. 4) once he had calmed, in an initial attempt to prevent recurrence of this act. However, the wolf became so obviously disturbed by the dead chicken

that it was shortly removed. Lupey remained restless for several days, although he was no longer aggressive. Considerable effort was made to keep him occupied and entertained. Various sacks, old shoes, etc., were given him to play with, and a 15 m nylon cord was purchased to give him more freedom during walks.

His weight on July 30 was 10.0 kg. He measured 47.5 cm from the ground to his shoulders, and 81.0 cm from tip of nose to base of tail. By August 18 (age 16 weeks) he weighed 15.4 kg, measured 51.0 cm from shoulder to ground, and 85.5 cm from tip of nose to base of tail. His tail filled out considerably and grew from 28.5 cm to 40.0 cm. His coat had begun to turn orange by this time, and prominent markings developed on his back. He ate approximately 1 kg food per day. His pull on a lead was measured at 7.5 kg.

By the age of 14 weeks Lupey was observed to follow a definite scent (winding trail of geese) for the first time. He chased the geese but only for a few seconds. He had killed two more chickens. None of these animals had been eaten. These two were more easily removed than had been the first one. There were but a few snaps and some whimpering. Some snaps were directed at objects on the ground (*e.g.*, sticks). After each kill he ate approximately double his normal rations. When on a walk at the age of 19 weeks Lupey suddenly cocked his ears and pounced on a vole that was behind him. Apparently he had heard the animal. He did not, however, kill it immediately, but rather pushed it about with both his paws and nose for several minutes. He finally rolled upon it. The vole was not eaten. Lupey remained hesitant when approaching horses, but had begun to show interest in them (Fig. 5). On several occasions he would grab their tails and hold on for several seconds as they ran off. More commonly he would nip at their tails or rear legs, and then quickly run away. He was occasionally kicked at but never hit, largely due to his extreme quickness. Nothing that could be called an attack upon the horses was seen, and several weeks after his first contact with them the horses were usu-

ally given little attention. If a horse rolled, however, the wolf became excited and had to be restrained. As Lupey became larger, his opportunity for contact with the horses was restricted.

During this period Lupey's play became noticeably *more* gentle. For example, it was possible to hold his jaws open with the two forefingers of one hand (contrast with Murie, 1944; Kramer, 1961). Pills (*e.g.*, for tape worm) could be placed by hand in his throat without being bitten. His general coordination also improved. He was taught simple tricks such as sitting and shaking hands for food. The contrast in the ease with which he learned these two tricks is interesting. Sitting on request took him several days to perform consistently, while shaking hands was performed perfectly after three trials. He would often lift his paw in normal play, but was rarely seen to sit. If I brushed his coat during this period he would occasionally nibble at my arm.

At the age of 20 weeks Lupey suddenly demonstrated strong avoidance upon being exposed to novel situations, *e.g.*, a saddle placed across a familiar fence. No particular previous experiential factor could be related to this. He would often glance up over his shoulder when disturbed by objects in front of him (*cf.* Kramer, 1961). Similar behavior was seen in the wolves of the same age in Regent's Park Zoo. New persons were also approached very cautiously at this time. Groups of persons elicited strong avoidance if they were unknown. Persons whom he had previously met even several weeks previously, and even when they were in groups, were greeted with excited pawing, tail-wagging, squeaking, etc.

Lupey's behavior with the dogs was generally gentle, and he would whine and howl if left alone. He would, however, show a brief ritualized grasping of the head of the large male wolfhound almost each time it was brought into his area. The wolf would also use his hip to push the animal, a motor pattern often seen in play. He was introduced to small puppies at this stage. Immediately he began a long series of high squeaks, often pawing one of the animals toward himself (Fig. 6). Following this he

sometimes briefly and gently grasped the animal in his jaws. The begging posture seen in Figure 7 often preceded play with the larger dogs. To initiate games Lupey sometimes jabbed the larger dogs repeatedly with his nose. There was a quite clear positive correlation between typical violence of the games and size of the dogs. For example, the smaller animals were often pushed with the *side* of his muzzle, and he often rolled onto his back, pawing. The wolf's motor patterns during play, such as in the use of his hips and paws, were noticeably different from those employed by any of the dogs and basically similar to those observed in wolves at Regent's Park. When a group of dogs barked Lupey normally howled. He gave only short whispered barks, and these were typically given in situations that could be described as mildly aggressive. Most of the wolf's adult motor patterns were well developed by the age of 6 months. Before urination partial lifting of a hind leg was sometimes seen, but only outside his yard (*cf.* Scott and Fuller, 1965). This was usually followed by urination in the pattern shown in Figure 10.

At the age of six months Lupey killed a cat that had previously frequented his yard unharmed (the animal in Fig. 4). The wolf was not subsequently aggressive, however, and other cats continued to remain in the yard. The wolf did snap at them occasionally. He grew more restless by the end of this 6-month period.

Age 6 Months-1 Year (First Winter at Farm)

From mid-November through February of his first year Lupey continued to have restless spells and was often difficult to calm. He also attacked several more cats, chickens, and geese. The animals often were not attacked unless they had previously fled. It should be emphasized that his behavior both with dogs and humans remained gentle. He would often make mock attacks and pounces, but without the "straight across" expression of his eyes, as Mrs. L'Angellier aptly called it, characteristic of genuine aggression. Indeed, he would avoid fighting with dogs, often turn-

ing his head and pressing his hips against the other animal. Vigorous romps between Lupey and myself were continued without incident. He did begin to demonstrate increased independence, as seen, for example, by his failure to perform learned tasks, such as sitting or coming, unless rewarded by food. He would obey warning tones, and could be prevented from carrying out actions without being struck. On one occasion, for example, he dropped a kitten he had just attacked when I shouted at him from inside the house. Precautions were routinely taken with children at this time, but he remained friendly and there were no incidents.

As a measure to help counter his tendency toward restlessness, Lupey was often allowed to run free with the dogs in an enclosed garden approximately one hour (Fig. 8). Many vigorous games were also played, such as having him leap for and fetch various objects (Fig. 11). In this way it was usually possible to tire him sufficiently so that he remained calm for the remainder of the day. Occasionally, however, he would have periods of restless pacing that we could do very little about. These might last for one or two days. During these periods he would often howl if left alone for any time.

Lupey was also brought into the house for brief intervals during this period. No attempt was made, however, to house train him. He normally would climb excitedly over, and pull at, various furnishings for several moments, then become more quiet. If dogs were present in the house vigorous play usually occurred. Figure 12 represents a rather different situation, an evening concert.

During the spring Lupey gradually became less restless. By late March he had begun to shed his heavy coat. This caused considerable difficulty by late spring. The skin over each hip developed large raw patches and had to be treated. Lupey would snap and growl-whine during these treatments, but immediately upon their completion he would cease. Thus, Lupey had succeeded to adjust to human manipulation for an entire year.

Second Year (Completion of Stay at Farm and Move to Rochester Kennel)

By the end of his first year, Lupey had become extremely attached to the farm dogs, particularly to a large golden labrador named Jester. Mrs. L'Angellier reported to me an observation which perhaps deserves mentioning in this context. From her kitchen she heard Lupey howl in such a unique and mournful manner that she went quickly to check on him. He had suddenly become very agitated. Shortly thereafter, one of Mrs. L'Angellier's sons rushed in to report that Jester's leg had been badly cut by a tractor in the field behind the house. The dog had yelped loudly. Whether this represents a coincidence or not, it is true that Lupey snarled menacingly at the veterinarian who came to treat Jester's leg. The two animals remained extremely close from that point.

During this time Lupey caught several more chickens and cats. Just before he was to come to the United States in February his attitude toward small children also appeared to change. He would watch them intently much as he had done with the cats, and from that point to the present particular care has been taken to prevent small children being with him alone. In January he also showed more aggression toward adults, but there were no serious difficulties and within a few weeks he returned completely to his previous state.

It was in February that Lupey was shipped to the United States. To accustom him to the trip he was driven several times in the car. On two occasions he was taken to the Regent's Park Zoo in London. He was permitted to see the wolves at the zoo, and gave his usual squeak greeting. The dominant animal in the pack stood very still, except for quivering of his entire body, and stared steadily at Lupey for about 15 min. Lupey was placed in a room at the zoo, where he became calm within a few moments. He was subsequently able to withstand television lights with no difficulty. He thus appeared capable of a voyage.

During the trip Lupey was given no medication and in return gave no difficulty.

After leaving the ship he was driven to a suburb near Washington, D. C., for a few days and then to Rochester, New York. The most notable event during this transition occurred when he slipped free from both catches on his two collars. He was approached by a young girl in the neighborhood, previously unknown to him, who held him until he could be retained. This indicated quite dramatically the success with which he had been socialized. A second interesting observation that occurred during his brief stay in the Washington area is that one morning he barked very loudly and for several minutes. He stood looking across one of the fields. This degree of barking had never been seen before, nor has it since.

Lupey was then driven to the kennel operated by the Coates family in Rochester. He quickly settled to his new environment, a run 20 m long and 2 m wide, with a shelter at one end. Figure 13 shows Lupey at the end of his second year.

Third Year-Present (Stay at the Kennel)

During his third year Lupey grew progressively more calm though still disturbed by rapid moving, loud, or novel environmental stimuli. Possible difficulty was anticipated during his third winter since he had reached sexual maturity, but none occurred. Indeed, a heavy snow in late January further emphasized his successful socialization. The weight of the snow pulled the wire on his run away from the building, and for two days he was missing. When located he was in a neighborhood approximately six miles away playing with local dogs and near several children. According to reports a large chow tried to fight him, but the wolf repeatedly turned his side toward the dog, sometimes pressing his hip against it. The chow left. Lupey continues to greet persons he has previously met with much enthusiasm. New persons are still approached cautiously, but with no aggression. The only aggressive episodes that have occurred have been when the animal is too inflexibly led in a particular direction. Slow persuasion remains the most successful tech-

nique. The wolf could be described as somewhat aloof in the sense that he prefers to be near people rather than to have them force themselves upon him. He has been exposed to many dogs at the kennel, and is generally amiable.

CROSS SECTIONS OF BEHAVIOR

The present section provides a brief summary and analysis of some major classes of behavior that have been outlined chronologically above. These divisions are again chosen as convenient representations of a broad spectrum of processes.

Basic Motor Components and Sequences

The core of many adult motor patterns occurred early in life. For example pelvic thrusts were seen by eight weeks. At this time the activity was brief and sporadic, and did not appear part of a flexible goal-directed sequence. The pounce (Fig. 2) was observed at an even earlier date. This represents an activity in which the simple motor sequence and orientation developed somewhat separately. For example, small moving objects, even several meters away, would often elicit pouncing in place. Comparable data have been presented by Eibl-Eibesfeldt (1963) for the development of prey-catching in polecats. Premature release of the young pouncing motor pattern is an additional important consideration. The typical posture of the wolf during howls was also well formed at a very early age (compare Figs. 1 and 12). Many of the simple motor patterns used in play (*e.g.*, pawing, pressing with hip) are of interest because of their considerable difference from the motor patterns seen in the dogs with which the wolf had been kept. It is apparent that Lupey could not have perfected these movements through direct imitation of other wolves, yet they were essentially identical to movements that developed in his siblings at Regent's Park. The possibility of less obviously relevant patterns of common experience is of course not precluded.

Certain basic behavioral components appeared to be present in quite divergent

functional patterns, *e.g.*, compare begging to play (Fig. 7) and rolling or rubbing postures (Fig. 9). Such observations appear compatible with the argument that underlying mechanisms may be shared by behavioral systems classified by other criteria as quite distinct (Delgado, 1964; Fentress, 1965). The rolling on fresh smells is of further interest since Darwin (1872) reports observations in which this pattern was said to be absent in wolves. The behavior was seen very commonly in both Lupey and siblings, and normally consists of alternate rubbing of opposite sides of the neck. It is often preceded by slow wagging of the tail. Pointing the head up and briefly back over the shoulder when frightened by objects or disturbances in front (*e.g.*, a group of persons), a behavioral pattern difficult to explain in functional terms, also occurred in both Lupey and siblings (*cf.* Kramer, 1961).

Expressive Behaviors and Vocalizations

Expressive behaviors and communicative postures in wolves have been well analyzed by Schenkel (1948). Facial as well as tail and ear musculature participate. Crisler (1959), for example, describes the wolf's "smile." My observations appear to confirm these reports, though the subtle gradations between expressions should be emphasized. In many respects also, the wolf has a Mona Lisa quality in which expression varies as a function of the observer.

The wolf's vocalizations obviously play an important role in its social behavior. Barks have been rarely heard in the present study, although they are not entirely absent. They usually have a short whispered quality. When nearby dogs bark, Lupey normally howls. He also howls to sounds such as a clarinet (Fig. 12). Figure 14 is a sonogram of a common deep howl. Note the inflection at its completion. In Figure 15 a more rapidly fluctuating howl with a final upswing is seen. It is apparent that considerable variation exists between howls. Howls after feeding, for example, are clearly distinguishable from howls when the animal is left alone. Howls are often preceded by a series of short whines and slow

tail-wagging. The high-pitched squeak (Fig. 16) appears to be a sound of considerable social importance. It is elicited, for example, when contact with persons or dogs is being established. Figure 17 shows an interesting case of "conflict." I had threatened to remove Lupey's food bowl. This resulted in loud growls, interspersed with a squeak similar to that mentioned previously. Note that the squeak overlaps the growl, but that the latter is momentarily interrupted as the squeak reaches its peak. Similar dual expression can be conveyed by the wolf in numerous ways, for example by grabbing one's hand in his jaws and simultaneously licking it.

Perceptual Processes and Reaction to Novelty

The wolf is an extremely alert animal and from an early age spends much time investigating his environment. When an element in this environment is altered, long lasting avoidance is often seen. In the present study, observations have been obtained that suggest placement in an entirely new environment may be less disturbing than alterations of a familiar environment. For example, Lupey adjusted quickly when placed in a strange room, but would often avoid for several hours new objects placed in his yard. Such data must be recognized as merely suggestive, but are compatible with models emphasizing the role of comparison between familiar and unfamiliar elements in avoidance reactions (Hebb, 1946; Melzack, 1952). The rapid change in fear responses that occurred at 20 weeks may be partially a reflection of having developed a familiar framework with which novel stimuli were compared. Possible mechanisms are difficult to separate, and more research is needed.

Chaining of Activities

During the first months of life changes between functionally separable behaviors were extremely rapid and difficult to predict. As the wolf developed, sequences of behavior became more stable and it is now often possible to predict actions some mo-

ments in advance. For example, rubbing on a strange object is usually preceded by a lowering of the haunches, a slow-low wagging of the tail, and a slight pulling back of the ears. Other sequences are less stable, such as scratching with the forefeet after defecation. External conditions may assist predictions. This scratching, for example, normally occurs only in strange territories. Similarly, lifting of the leg during urination is variable, but usually occurs only in strange locations (*cf.* Scott and Fuller, 1965). Vigorous running in figure eights may then follow. Similar running also often occurs following a hard wrestling bout between the wolf and me.

It is apparent that such behavioral sequences and the context of their occurrence suggest many problems for the organization of underlying systems (*cf.* Fentress, *in press*). For example, if the animal is placed in a strange environment, feeding and other maintenance activities will normally be suppressed, but may be subsequently enhanced when he is returned to the home cage (*cf.* Barnett, 1963). Various disturbances in the home area have also been noted to increase feeding. This appears to depend partially upon the intensity and clear focus of the disturbance. Feeding was also greatly intensified in both vigor and duration following the killing of a small animal. Chewing on objects, including food, is a common sequel to a period of wrestling. The potential variety of interactions between behavioral mechanisms appears considerable in even this relatively simple set of data. Descriptive terms such as "displacement" or "redirection" become difficult to apply with precision (*cf.* Schenkel, 1948).

Results of Socialization

In contrast to the observations on a male wolf by Kramer (1961), Lupey has remained successfully in close contact with man for more than three years. The development of his relationship has been discussed above. At the present time, people are not only tolerated, but their attentions sought. Greetings with much squeaking,

pawing, and tail-wagging are common. If left alone he may howl, particularly if he has just been visited for a short period. After a few moments of contact, however, the wolf often moves away. When given free runs in a fenced field he may spend considerable time avoiding direct contact with people. At varying intervals he will reapproach and remain briefly, then again move off. If the person leaves he will attempt to follow.

It remains possible to play vigorously with the wolf. He will indeed often initiate games by punching me or some other person several times with his nose, jaws closed. If one runs away, he will chase; if one chases, he will run away. He will often take articles not carefully guarded (*e.g.*, hats or gloves) and keep them just out of reach. It is possible to coax these away from him. He can be stopped from an action by vocal request. Requests to perform particular behaviors, on the other hand, may be either obeyed or ignored. He may snap briefly if it is necessary to treat an infection (*e.g.*, ear canker), but becomes amiable immediately after treatment is completed. Aggression can normally be avoided if the wolf is not forced too quickly or inflexibly in one particular direction.

The distinction made by Ginsburg (1965) between successful socialization and tameness is supported by the present study. Lupey is still easily frightened by sudden movement or by the presence of conspicuous novel objects (*e.g.*, unfamiliar car). He can be difficult to calm in such instances.

With dogs he remains very amiable. New dogs coming to the kennel, for example, are usually greeted with squeaking and pawing. He has attacked smaller species occasionally, such as chickens, cats, rodents, and rabbits, but one must take care to distinguish such behavior from his relations to either man or dogs. His interaction with small children has been restricted as a precaution, and therefore conclusions about this aspect of socialization must remain open.

It is of course tempting to compare the behavior of a wolf with that of dogs, but precise statements are difficult. The ques-

tion of comparative "intelligence," for example, might be answered very differently with different tasks. To illustrate, Lupey learned to shake hands upon very few trials, but performance upon request to sit remained poor. Wolves lift their paws during play more readily than do most dogs, but sitting appears less frequent than in dogs. There is also the important distinction between relatively fixed motor components and more flexible organization or orientation of motivational tendencies. In comparisons concerned with socialization there are the additional problems of variability between breeds of dogs, and probably between wolves themselves (Young and Goldman, 1944). Dogs did not derive from wolves that exist today, but it appears likely that primitive man would be able to take a common ancestor and produce the highly socialized dog.

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