

THE EDUCATION OF KOKO

Francine Patterson & Eugene Linden

PHOTOGRAPHS BY RONALD H. COHN



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Epilogue 1 (1981)

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PREFACE

Koko is [now a 31 year-old] female lowland gorilla. She is the first of her species to have acquired a human language. This is the story of Project Koko, the longest ongoing study of the language abilities of an ape yet undertaken. The project was initiated by Dr. Francine Patterson in 1972 and is still continuing today.

The Education of Koko is the cooperative effort of Eugene Linden and Francine (Penny) Patterson. Eugene Linden has written extensively about the various language experiments with the great apes, and it is his feeling that Project Koko has achieved the most extraordinary results of any of the language experiments with animals. As this book will be dealing primarily with Dr. Patterson's research and the events that have marked Project Koko, the authors have decided to use her voice to present the details of her work. The interpretation of these details reflects the consensus of both authors.

ACKNOWLEDGEMENTS

I owe an enormous debt of gratitude to Dr. Ronald H. Cohn for his continuing support, advice, and help. Throughout the entire project, he has shared the responsibilities, hardships, and problems but has rarely received recognition for his efforts. Dr. Cohn has done an outstanding job of photographically documenting Koko's achievements during the past nine years [this was in 1985; Dr. Cohn is still documenting as of 2002].

My sincere thanks also to Barbara Fallon Hiller, Koko's oldest and dearest friend, who has contributed to the success of the project in innumerable ways, generously donating both time and money. Barbara's comments on the manuscript in its various phases were invaluable.

There are many, many others who have provided invaluable assistance along the way, and I wish to extend my thanks to each, particularly the volunteers who worked on Project Koko. Here I would like to single out just a few deserving special mention: Ronald Reuther, who as director of the San Francisco Zoo granted me permission to begin the project with little Hanabi-Ko; Edward Fitzsimmons, attorney at law, who helped establish the Gorilla Foundation and for years has generously donated his time and advice; my late mother, Frances Spano Patterson, whose loving spirit provides inspiration; my father, Professor C. H. Patterson, who has always given me encouragement and support; Dr. Jane Goodall, who has aided the project at critical times over the years; Mrs. Clay West Head, who provided funds to help secure Koko; and all the members of the Gorilla Foundation, whose kind letters and generous contributions have heartened and sustained us.

I would also like to express my deep appreciation to the National Geographic Society for awarding grants in support of my project from 1976 to the present [1985], and to the Djerassi, Favrot, and William Penn Foundations for providing timely grants-in-aid for specific needs. And for recent and most wonderful contributions for improving the gorillas' habitat, I extend my thanks and heartfelt gratitude to Mrs. Henry Doelger.

Finally, I wish to make a special tribute of thanks, praise, and love to Koko and Michael.

- Francine Patterson

I would like to thank all of the Project Koko workers and volunteers who helped me during the researching and writing of this book, particularly Barbara Hiller, Ann Southcombe, Kris Hanson, Barbara Weller, Maureen Sheehan, and Malka Kopell. And, for their stimulating conversations about various issues raised by Project Koko, I would like to thank Lee Blaine and the other logicians and scholars I encountered at Stanford University during my periodic trips out west.

Jim Wilcox and Iver Kern read sections of the manuscript at different stages of completion, and had many excellent suggestions.

I owe my greatest debt to our editor, Natalie Chapman. Throughout the writing of the book, Natalie showed prodigious patience, tireless attention to detail, and deft editorial judgment.

- Eugene Linden

PART I

Getting Started



CHAPTER 1

Conversations with a Gorilla

When I began teaching Koko American Sign Language nine years ago, I had no idea how far she would progress with it. There was little reason for me to assume that a gorilla could learn to use language to rhyme, lie, joke, express her emotions, or describe her world.

Nor could I have anticipated that the intense controversy ape-language experiments generated within the behavioral sciences a decade ago would still be continuing today. During the past few years the idea that any nonhuman can acquire language has been denounced with renewed vigor, and yet ironically it is also within this time that Koko has begun to demonstrate her most remarkable abilities.

Just how far those abilities extend is difficult to answer. Take one simple example. A visitor recently stopped by to see Koko. On greeting the 180-pound gorilla, the visitor pointed to her and then made a small circle with her open hand in the air in front of her own face, signing *You're pretty*. Koko digested this comment for a moment and then stroked her finger across her nose; her reply meant *false* or *fake*.*

Was Koko's response an indication of modesty, or a comment on her visitor's sincerity? Was it a random gesture carrying no significance? Was she simply imitating someone else's previous response to the same compliment? To prove what Koko meant - or that she had any feelings about her looks at all - is a maddening proposition. It means establishing that Koko in fact made the sign cited, that she knew what she meant, and that her behavior was intentional, not imitative or cued.

That is the job of this book - to show how Koko learned language, and *that* Koko learned language; and to look at what a gorilla does with human language.

Why does anyone care whether or not an animal can learn language? This issue has intrigued humankind from Plato and Descartes to contemporary scientists and thinkers, for thousands of years. But its importance was perhaps best expressed recently by Walker Percy:

Where does one start with a theory of man if the theory of man as an organism in an environment doesn't work and all the attributes

All signed words (those made in American Sign Language) are indicated in italics.

of man which were accepted in the old modern age are now called into question: his soul, mind, freedom, will, Godlikeness?

There is only one place to start: the place where man's singularity is there for all to see and cannot be called into question, even in a new age in which everything else is in dispute.

That singularity is language.

Why is it that men speak and animals don't?

What does it entail to be a speaking creature, that is, a creature who names things and utters sentences about things which other creatures understand and misunderstand? . . .

Why are there not some "higher" animals which have acquired a primitive language?

Why are there not some "lower" men who speak a crude, primitive language? . .

Why is there such a gap between nonspeaking animals and speaking man, when there is no other such gap in nature?

Is it possible that a theory of man is nothing more nor less than a theory of the speaking creatures?

When Walker Percy wrote these words in 1954 in *The Message in the Bottle*, he could speak with confidence - and find unanimous support from scientists - about the fact that only man might learn language. According to the traditional wisdom of the behavioral sciences, animals can only signal. Their communication consists of a preprogrammed series of instinctive reactions to the immediate demands, fears, and pleasures of their lives. In the 1960s, however, a series of experiments involving two-way communication with apes began to erode that traditional wisdom.

Language-using apes have not only destroyed our confidence about the uniqueness of language—and therefore of man—but have also exposed uncertainty in the scientific world about what exactly "language" is. And the experiments have raised the question of what the apes are doing when they communicate with their human mentors. Are they in fact using language, or are they merely interpreting nonlinguistic signals unconsciously given by the experimenters? In short, have apes learned language or have they learned a circus trick?

If, as we hope to show, claims that we can talk with the animals are legitimate, then what they have to tell us far outstrips what we might imagine. In the nine years during which she has been taught American Sign Language, Koko has learned not only a large number of words,

but also a great deal about language. It has become an integral part of her daily life. The language Koko uses, American Sign Language, or Ameslan as it is called by the deaf for whom it is a primary mode of communication, is the fourth most commonly used language in the United States. It is not English. It is a gestural language, and there are marked contrasts between the way a statement is made in English and the way it is made in sign language. For instance, it takes on an average about twice as long to complete a word in a gesture as it does to say an equivalent word in English. This constraint places a premium on economy of expression. (Thus, the written translation of statements made in sign language has a stilted, telegraphic quality.)

Koko's conversation has changed dramatically through the years. At age three, Koko was manifestly an infant. She showed a great deal of dependence, a lot of brattiness, and relatively little signing in general. Many of her attempts at signs were unclear or inappropriate. A high percentage of her statements during this early period were requests for some form of sustenance or stimulation (tickling, chasing, swinging - these were very frequent requests). Indeed, a reading of the records might give the misleading impression that Koko was living on the edge of starvation and getting by precariously on handouts: *Pour that hurry drink hurry . . . me me eat . . . you me cookie me me . . . gimme drink thirsty*, and so on.

By age six, she was exhibiting her own ideas about language and the uses to which it might be put - such as expressing her increasing independence. One day when Koko was six I came in at 6:00 P.M. to put her to bed and relieve Cathy Ransom, one of my deaf assistants. Before leaving, Cathy pointed to the notebook in which all of Koko's utterances are logged. There I found Cathy's transcription of an "argument" she and Koko had just had in sign language. The dispute had begun when Cathy showed Koko a poster picture of Koko that had been used during a fund-raising benefit. Cathy had signed to Koko, *What's this?* by drawing her index finger across her palm and then pointing to the picture of Koko.

Gorilla, signed Koko.

Who gorilla? asked Cathy, pursuing the conversational line in typical fashion.

Bird, responded Koko.

You bird? asked Cathy, not about to let Koko reduce the session to chaos.

You, countered Koko, who by this age was frequently using the word *bird* as an insult.

Not me, you bird, retorted Cathy.

Me gorilla, Koko answered.

Who bird? asked Cathy?

You nut, replied Koko, resorting to another of her insults. (Koko switches *bird* and *nut* from descriptive to pejorative terms by changing the position in which the sign is made from the front to the side of her face.)

After a little more name-calling Koko gave up the battle, signed, *Darn me good*, and walked away signing *Bad*.

Cathy and Koko's argument illustrates one of the principal lessons of Project Koko, which is that in being "bad," Koko can be very, very good. Throughout the nine years of the project, Koko has been driven to her most creative uses of language through her obstinate refusal to submit meekly to dull routine. Indeed, the most telling proof that Koko understands the language she is using is the way she adapts it to express her impatience and other feelings.

Today, at ten, Koko is somewhat less mischievous, and much more verbal, than she was at three. In Koko's conversation today we see her ability to "build up" complex ideas through a series of short statements. How Koko does this, and the thoughts she expresses this way, is what this book is about.

CHAPTER 2

Getting Started

Project Koko began in July 1972, the day after I received permission from the San Francisco Zoo to attempt to teach Ameslan to an infant gorilla. I had had my eye on this gorilla for nine months. In fact, I had begun planning Project Koko the day I first saw little Hanabi-Ko, or Koko, as she was nicknamed. And months before I first saw Koko, I had decided that I would devote my graduate education to the study of the language abilities of animals.

I was inspired by a lecture delivered at Stanford University by Allan and Beatrice Gardner, the comparative psychologists who first succeeded in teaching language to a great ape. This was in September 1971, five years after the Gardners had begun their work with Washoe, a chimpanzee, and ten months before I was to begin working with Koko. I had read some material on the Gardners' research, and wanted to hear them describe their methods and their accomplishments and see the films of Washoe conversing in sign language with her human companions.

As the Gardners described how they got the idea to teach sign language, their search by trial and error for a proper teaching method, the elaborate controls they developed to ensure that their data were reliable, and finally Washoe's willing response to their efforts to teach her language, I felt increasing excitement. Clearly there might be untapped language abilities in other animals as well. Although the Gardners delivered their lecture soberly, I felt that I was hearing about something from the realm of myth or fable: Animals were capable of telling us about themselves if one knew the proper way to ask them.

This lecture gave focus to my lifelong interest in animals. I started planning to try to find an ape and the funding that would permit me to pursue research along similar lines, and I enrolled in a course in American Sign Language. My inclination was to work with chimps because they were noted for their tractable, gregarious nature. At first I did not entertain the idea that it might be possible to try to teach language to a gorilla. But I would have leapt at the chance to work with any great ape.

I did have some background working with primates. I had entered the doctoral program in psychology at Stanford in the fall of 1970, after receiving a BA in psychology from the University of Illinois and

traveling west with Ronald Cohn, a molecular biologist and close companion who has devoted all his free time to Project Koko since its inception. My interest in psychology came from my father, who is a professor emeritus in educational psychology at the University of Illinois and has published several books on counseling and psychotherapy. For me, however, graduate work in psychology was attractive because it would permit me to work with animals.

To the nonresearcher, the idea of a behavioral scientist "working with animals" often conjures up an image of the horrors of vivisection. This was not what I had in mind. I count myself among a "new breed" of behavioral scientists who would rather observe an animal than take it apart. We are more interested in understanding animals in their own right than in seeing how they might be used to understand and cure human problems. Indeed, the most delightful aspect of my work with Koko is that language allows us to see the complexities and subtleties of the gorilla's mind.

In effect, my career in psychology has been one of climbing the primate ladder - if in fact we can consider one primate higher than another. I began at Stanford working on a study of attachment behavior in rhesus monkeys under the guidance of Karl Pribram, a leading theorist on neuropsychology. In this study, infants were separated from their mothers (briefly) to prove what seemed to me the obvious point that they would prefer their mother to a peer and a peer to an empty cage as a source of comfort in an anxiety-producing situation.

Next I became involved in a study of self-recognition in gibbons. Simply put, this means that I was trying to see whether a gibbon knew whom it was looking at when it saw its image in a mirror. I found this study more intriguing because it would indicate whether the ape has any consciousness, a quality that had proven chimps capable of self-recognition, and the purpose of the study of gibbons was to help to determine how far down the evolutionary scale this ability might extend. The six months of the study produced no signs of self-recognition in the gibbons.

It was shortly after I began work on the self-recognition study that the Gardners came to Stanford to speak. From that moment onward, I began looking for opportunities to work with a chimp, or failing that, any great ape. Thus I agreed instantly in September 1971 when Karl Pribram suggested that I accompany him to San Francisco to look at the gorilla colony there. Dr. Pribram was toying with the idea of constructing a sturdy console with an encoded keyboard connected to

a computer, which he would then use to teach the gorillas to communicate by pressing different keys.

When we arrived at the San Francisco Zoo, we met the director, Ronald Reuther, and then walked over to the gorilla grotto, a large, rocky, cement area separated from onlookers by a dry moat. While Dr. Pribram and Mr. Reuther discussed the pros and cons of the proposed experiment, I became absorbed watching the gorillas idly pass the day. The tableau was a study in lassitude, broken only by a little struggle between a mother gorilla and her infant. The tiny gorilla was clinging ferociously to its mother, who kept pushing the baby up onto her back, only to have the baby slide off each time. The sight of the infant brought my mind back to my quest. I was not that interested in Pribram's proposed experiments because I had already concluded from my reading on the subject that a sign language was the most productive way to study ape language abilities. As I watched the infant I thought, "Well, Pribram can have his experiment, and I will just have mine with this baby." It did not turn out to be so simple.

When I made a proposal to the zoo director, I was turned down. A primary goal of the zoo was to breed endangered species such as the gorilla, and Mr. Reuther, sensibly enough, felt it would not advance that purpose to separate the infant from its mother at the tender age of three months. Undaunted, I continued my study of Ameslan and resolved to find another gorilla or wait until this infant was older. I tried to find out what I could about the baby gorilla and her circumstances at the zoo.

The infant was Koko. The mother who had so peremptorily placed her daughter on her back was Jacqueline, nicknamed Jackie. Poor Jackie had previously suffered the indignity of being thought to be a male. In fact, she had been purchased from the Brookfield Zoo in Chicago to be the mate for Missus, one of the San Francisco Zoo's female gorillas. Jackie came to San Francisco courtesy of Carroll Soo Hoo, a philanthropic businessman, who donated the money to purchase Jackie - then named Jacob - and another gorilla. The zoo expectantly closeted Jacob with Missus and nervously wondered why the couple did not hit it off and raise a family.

Ultimately, the zoo discovered their error and, with some embarrassment, decided that the cause of breeding gorillas might be better served if Jacob was put in with a male. The zoo changed her name to Jacqueline, and undoubtedly to her vast relief, Jackie was introduced to Bwana. They did mate, and a female gorilla was born on the Fourth of July in 1971. The zoo held a contest to choose a name

for the infant. The winning entry was Hanabi-Ko, Japanese for "Fireworks Child."

The zoo's plan to keep Koko with her mother did not work out as they had hoped. Shortly after Dr. Pribram and I visited the gorilla grotto, Koko's health began to deteriorate. Jackie was a good mother, but the San Francisco Zoo is not the jungle. Jackie's milk was not sufficient to keep Koko nourished, nor could Koko supplement her mother's milk with forage as infant gorillas are reported to do in the wild. She became undernourished, and when an outbreak of shigella enteritis swept through the gorilla compound, she almost died. Suffering from malnutrition, racked with diarrhea and septicemia, hairless, and dehydrated, Koko was a pathetic 4 pounds 14 ounces - the average birth weight of gorillas - at the age of six months. At that point, just before Christmas, Koko was separated from her mother and taken to the Animal Care Facility of the University of California Medical Center in San Francisco for a few days before being taken into the Reuther household for two weeks. With round-the-clock care, she recovered sufficiently to be transferred to the house of Deedee and Landis Bell, manager of the Children's Zoo, on the Children's Zoo grounds. After six months in the Bell's care, the zoo felt it was time to put Koko back on permanent display, and installed her in the nursery of the Children's Zoo. Subsequent examinations determined that she had suffered no discernible lasting harm as a result of her illness.

At about this time, I made another trip to the zoo. I had come up to photograph gibbons as part of the self-recognition study. I ran into one of the keepers, Marty Diaz, who told me about Koko's illness. He suggested that the zoo might now listen more favorably to a proposal, if I still wanted to work with Koko.

Marty Diaz was most sympathetic to my desire to work with sign language, and he offered to speak to Mr. Reuther on my behalf. That same day, I asked my advisor for permission to switch to a language project with Koko. Mr. Reuther and my advisor both granted their permission, and the very next day, with no funding, few private resources, and a yet no formal project design, Project Koko began.

Too excited to be tired from a night sleepless with anticipation, I drove from Stanford to San Francisco with Ron Cohn to meet Koko on a foggy Wednesday morning on July 12, 1972. When I entered the nursery of the Children's Zoo, Koko left the arms of her caretaker, Debbie Lee, for mine. She pushed her soft face close to mine, smelling me and looking me over. Then Debbie put the 20-pound gorilla, all

black save for a white rump patch, onto the nursery floor and I signed, *Hello* (a gesture somewhat like a salute). Koko put her hand on her head and patted it and then promptly pulled my hair as I sat down.

The glimpse I had caught of her sleeping serenely in her basket the day before did not prepare me for this interaction - she was a real dynamo and seemed much bigger this day. While Debbie was in the room with us, Koko responded to my beckoning *come* gesture, but later, when alone with me, she went on about her play with her toys as if I wasn't there. Whenever I stood up, however, she rushed to my feet and started to scale my legs- evidently she thought I was leaving. At one point Koko became excited and played a game of peekaboo behind a door with Ron when he and Debbie joined me in the room for a quick photo session. Later, while Debbie and I chatted, Koko bit me a couple of times. Taking this as a sign that we had perhaps overstayed our welcome, Ron and I departed for the day.

The next morning I arrived at 9:00 A.M. with a wading pool for Koko. She cautiously put her nose up to it, touched it, and nibbled on the edge. When Debbie placed Koko in it, she immediately ran her fingers over the upraised bubbles on the bottom of the pool. She delighted in running in and out of it and splashing in a few inches of water. Excited by the pool, she nipped me several times, but by now I was learning to anticipate and divert these testy assaults.

While the zoo volunteers performed the morning chores I joined Koko in the nursery. She still ignored me often, but when the horses, goats, and sheep were let out into the zoo yard and stampeded by the nursery window, Koko scrambled over to me and briefly clung to my clothes. Then the whirring of the blender to mix her formula of simillac and strained cereal set her into a frenzy of activity: She vigorously banged her toys around, and repeatedly pounded on and rolled herself over a rubber dog. She interrupted her wild play only to peer under the door to the adjoining room where her bottle was being prepared and to hammer on the door periodically. I asked the zoo volunteers to sign *drink* before feeding Koko her formula and *up* before picking her up.

Initially, Koko seemed to prefer men to women. During the first week, she was more inclined to interact with Ron and my office mate, John Bonvillian, than with me. She took to John very well - examining his beard closely, sniffing, fingering, tasting, and yanking it. She climbed all over him jungle-gym style and rode on his back. Ron also got the jungle-gym treatment, and Koko was very responsive to him. She imitated his twisting of a knob on her toy clock, and his clapping.

When my male friends were present, Koko interacted very little with me. I also somewhat enviously noted that she never attempted to bite them. After a couple of weeks, though, she seemed to conclude that I was a reliable, and likely to be a permanent, fixture in her life. She attempted to bite me less and less frequently, and she also began to show a preference to be held by me rather than by a man when she had an alternative. Her first response when frightened was to jump into my arms and cling tenaciously.

From the beginning of Project Koko I had a dual role: I was a scientist attempting to teach a gorilla a human sign language, but I was also a mother to a one-year-old infant with all an infant's needs and fears. My initial problem was to establish rapport with Koko, who was, perhaps because of the unsettling events that had marked her short life, at first suspicious of this strange blonde human.

Each morning before the zoo opened to the public I would carry Koko for walks through the Children's Zoo. I felt it was important to get Koko out of the confines of the nursery at every opportunity. At first I had no need to restrain her with a leash; for one thing, it is normal for an infant gorilla to stay on or near its mother for the first year and a half of life, and for another, Koko was terrified of the large animals (particularly a baby elephant who was fond of trumpeting every morning) and wouldn't venture from my side. The only large animals that Koko could intimidate at that age were a herd of surpassingly stupid llamas. They would congregate at the fence when we passed, apparently under the impression that we were zoo goers bearing llama food. Koko would rush at them threateningly and enjoy with evident satisfaction the stampede she precipitated.

One animal Koko was particularly afraid of was the gorilla. When I took Koko on a trip to see her parents at close quarters inside the gorilla compound, her relatives gathered quietly to examine the little gorilla. Bwana, the dominant male and protector of the group, was upset when he first saw us approach; he barked, followed us, and threw feces at us. Frightened, Koko squirmed and defecated in my arms. We left in a hurry.

With the beginnings of our rapport, the problem was to focus Koko's attention on hands. Koko was, after all, only one year old, and when not asleep, she was constantly moving and exploring. I would construct little games to divert her and show her the utility of her hands. I breathed fog onto the glass of the large windows in her room and then drew stars and simple faces on the misted surface. Koko

loved these games and would attempt to draw as well, although what appeared were amorphous squiggles.

It was impossible within the confines of Koko's display cage to seal her off from spoken languages (the glass was hardly soundproof and some zoo visitors seemed to take it as a sacred obligation to make remarks to Koko and whoever was in with her). Consequently, I decided to make a virtue of necessity by adopting a method known as "simultaneous or total communication." This simply means that the speaker accompanies his signing with the spoken equivalent of the message.

The ambitions of the project were quite modest at first. On July 22, Karl Pribram and I spoke with Ronald Reuther about the amount of time I was to be allowed for the project. Mr. Reuther's idea was to reunite Koko with the other gorillas as soon as possible, which he thought would be in about six months. On the other hand, Landis Bell, the director of the Children's Zoo, thought Koko should not be put back with other gorillas for about three years. I was a bit disappointed at this point, since I hoped to carry on my work with Koko for as long as the Gardners had worked with the Washoe - four years. On the other hand, Dr. Pribram felt that I should concentrate on teaching Koko only three or four signs. I thought she could probably handle more than that, but decided to begin by molding and shaping *drink*, *food*, and *more*.

I would divide Koko's bottle into two portions, and would sign *drink* before giving her each portion. The *drink* sign is made by shaping one's hand somewhat like a hitchhiking gesture, and then placing the extended thumb to the lips. While preparing and offering the bottle, I made this gesture, and then attempted to get Koko to make the gesture. Koko, being a one-year-old, had few thoughts other than getting her hands on the bottle, and then the bottle into her mouth.

Although I tried for a strict routine, we were frequently interrupted when children came up to the glass, and then, when she discovered they were out of reach, she would pound on the glass in frustration. Her principal amusement those first few weeks was to close her eyes and spin wildly around the cage - something gorillas do in the wild. As Koko grew older, she embellished this game by pulling a blanket over her eyes, generally when she had some mischievous intent, such as giving a playful smack to a human companion. Possibly Koko felt that by pulling the blanket over her eyes she became invisible. Indeed, she was perpetually surprised to find herself accused of these petty assaults.

During the first few months of the project, the Children's Zoo volunteers who had looked after Koko before my project began continued to look after her when I could not be with her. At the end of the first summer, these volunteers had to go back to school during the week, but I was able to fill the gaps with two new volunteers who offered their services. One was a deaf woman, the mother of my sign language teacher. The other was Barbara Hiller, a docent at the zoo. Barbara cared for Koko from the time she was in diapers and is still with the project today. Later in the fall, the Stanford psychology department provided salary money that permitted me to hire Hank Berman, an assistant whose native language was sign.

As Project Koko got underway, I had the advantage of surveying the trial-and-error approach to teaching language used in previous experiments with chimps. These experiments also produced a great fund of information against which I might judge Koko's performance - if, in fact, she learned language at all. In 1972, when I began Project Koko, there were a great number of scientists who disputed that the chimps' achievements had any linguistic significance. Project Koko began during turbulent times in the behavioral sciences, and it was only because of previous pioneering work with chimps' that I had any chance of being taken seriously. My cause was not helped by the fact that the subject of my experiment was not a chimp, but a gorilla.

CHAPTER 3

Gorilla Gorilla

If some of my colleagues were skeptical of my ambitions to teach a gorilla sign language, it was partly because of the gorilla's reputation for being ferocious, stubborn, and stupid. While chimps have traditionally been the teacher's pet of the behavioral sciences, the rare, self-absorbed gorilla has been given a wide berth by scientists mindful of the animal's strength. Throughout the century timorous researchers have justified this neglect by reciting like a catechism a literature on the animal's intractable nature and dubious intelligence.

The gorilla, as every reader knows, has not had a good press. Part of its problem is that the gorilla does not have much documented history. Creditable sightings only date from the mid-nineteenth century. Early accounts spoke of the animal's ferocity and enormous strength. One hunter reported that an enraged gorilla grabbed his gun and crushed the barrel with his teeth. The French-American explorer Paul du Chaillu probably did most to create the popular image of gorillas that still persists today. Du Chaillu caught the public imagination with his lurid description of a gorilla kill in 1861: "His eyes began to flash fiercer fire as we stood motionless on the defensive, and the crest of short hair which stands on his forehead began to twitch rapidly up and down, while his powerful fangs were shown as he again sent forth a thunderous roar. And now he truly reminded me of nothing but some hellish dream creature - a being of that hideous order, half-man half-beast, which we find pictured by old artists in some representations of the infernal regions..." The legacy of such reports shows in a recent poll of British schoolchildren: gorillas ranked with rats and spiders as the most hated and feared creatures on earth.

Given the gorilla's awesome image, many people asked me how I would dare to enter the cage of an animal that so terrorized the brutish hunters of the last century. For one thing, I had read another body of scientific literature that described an entirely different animal from the hellish creature of the popular accounts (although even some scientific writings fell prey to superficial prejudices based on the gorilla's appearance). According to George Schaller and Dian Fossey, who have studied gorillas in the wild, they are peace-loving vegetarians despite displays they may use to greet intruders. They roam the forests of Central Africa in nomadic bands of some two to thirty individuals led by a dominant older male. Their communication

consists of a combination of postures, gestures, and vocalizations. A sideways glance and an annoyance bark from the dominant male are usually enough to resolve disputes; a grunt or purring vocalization indicates contentment and social harmony. The life span of gorillas in the wild is not known; conservative estimates place it at thirty. In captivity gorillas have been known to reach fifty. In physical development, a ten-year-old gorilla is roughly equivalent to a twelve-to-fifteen-year-old human. Although females are willing to mate from about age seven to nine in the wild (about six in captivity), they usually do not conceive until age ten or eleven (seven to ten in captivity). Males are ready to mate at about age nine or ten. The female often initiates courtship when she is in estrous, and the male usually indicates interest only then. Gorillas in the wild tend to spend much of their time lolling about, eating several times a day from a ready supply of vegetation; and, except for man, they have no enemies.

These firsthand reports of the gorilla's gentle nature, along with the photographs Carroll Soo Hoo had often shown me of himself roughhousing with Bwana and other 200-pound gorillas, were enough to still any doubts I might have entertained about the dangers of working with Koko.

Contrary to its popular image, the gorilla is less aggressive, less excitable, and in some ways a good deal easier to work with than I had anticipated. That this is not better known is partly because the gorilla is very difficult to obtain for research. But I suspect that many researchers would rather not risk giving a 400-pound animal the benefit of the doubt that is necessary to find out what the animal is really like. Most, if given a choice, would probably prefer to work with chimps, who genuinely seem to enjoy the company of humans. Roger Fouts, a psychologist who has extensively studied chimp use of sign language, remarked that he did not like the way gorillas hunker down at a forty-five-degree angle, turn their heads, and stare sideways at him. Because so little work has been done with gorillas, they have been unfairly regarded as an intellectually disadvantaged, moody, and uncooperative poor relation of the great apes.

Gorillas are great apes, a term that refers to the family Pongidae, or pongids. It includes the orangutan (*Pongo*), the chimpanzee (*Pan*), and the gorilla (*Gorilla gorilla*). The orang, or red ape, is a native of Borneo and Sumatra, while the chimp and gorilla are now found only in an ever-diminishing band that runs through equatorial Africa. All three are threatened in the wild by habitat destruction, hunting, and what is euphemistically called "collection" for zoos and laboratories.

There are only some 250 mountain gorillas left in existence; lowland gorillas number fewer than 5,000 and 10,000. It is unknown whether the gorilla was ever particularly abundant, but its existence, in spite of recent laws to protect it, is now possibly the most precarious of all the great apes.

Together with the lesser apes (the gibbons and the siamang) and man, the great apes are members of the superfamily Hominoidea. Hominoidea, in turn, is a part of the suborder Simiae of the order Primates.

Scientists have long debated over which of the great apes is man's closest relative. Depending on whom you talk to and what aspect of the ape's physiology is being examined, researchers make varying claims for the chimp or the gorilla.

Adding to this confusion is the assertion by some scientists that the orangutan's brain most closely resembles man's in certain anatomical ways related to the evolution of language. This is somewhat surprising, because the orang is commonly regarded as man's most distant relative among the great apes. For the moment, the question of which ape is most closely related to man will have to be considered open because of the lack of comparative data.

Also unsettled is the issue of which great ape is the most intelligent. Such a question is somewhat charged, since we would hardly be comfortable if our closest relative turned out to be somewhat of a dolt compared with the other two. For a long time it was generally assumed that the chimp was the brightest, although there is little hard data to back this up. In fact, as people are asked how they know the chimp is bright, many will cite the descriptive tag on the chimp cage at the zoo. Because we consider the chimp our closest relative, we have tended to accept its intellectual superiority over the gorilla without too much scrutiny. And since chimps are the easiest of the three great apes to test for intelligence, the claim tends to become a self-fulfilling prophecy.

Before Project Koko got underway, Duane Rumbaugh administered a series of tests to determine the relative intelligence of a group of chimps, orangs, gorillas, and a pygmy chimp. The tests were inconclusive. One orang consistently had the highest scores. But Rumbaugh wondered how significant the gorilla's low scores were, since it frequently disrupted the test and ultimately crashed the test apparatus.

Later learning tests were more conclusive. Required to discriminate between different objects according to varying criteria, the gorilla and orang both performed better than the chimp. Rumbaugh believed that his data had at least exploded the myth of chimp intellectual superiority among the great apes. He remarked that the difference in mechanical aptitudes, or simply in how the animals felt on a particular day, may have had a lot to do with the differences in their performance. (To this observation I say amen.) Rumbaugh noted that vocabulary size would probably be the most reliable measure of intelligence, but since he conducted these tests before it was believed that the apes might develop any vocabulary at all, he had to conclude ruefully that the question was, for the time being, moot. The breakthrough in communicating with chimps, oranges, and gorillas has fostered a renaissance in the study of ape intelligence. I will come back to the issue of intelligence later.

It was probably because of behavior like that of Rumbaugh's gorilla destroying the test apparatus that the gorilla developed its reputation as difficult. Two researchers, Hilda Knobloch and Benjamin Pasamanick, went so far as to claim that the gorilla was uncooperative because it was stupid: "There is little question the chimpanzee is capable of conceptualization and abstraction that is beyond the abilities of the gorilla. It is precisely because of these limitations, which are apparently genetically determined...that it is more difficult to work with them." The great primatologist Robert Yerkes shared some of these feelings, but he also suspected that the gorilla's intransigence might indicate the presence of intelligence rather than its absence. In 1925 he wrote, "In degree of docility and good nature the gorilla is so far inferior to the chimpanzee that it is not likely to usurp the latter's place...in scientific laboratories." It also occurred to Yerkes that the gorilla was "a natural experiment in which the value of brawn versus brain is being determined." Ultimately, however, Yerkes's clearheaded understanding of his beloved apes led him to observe, "It is entirely possible that the gorilla, while being distinctly inferior to the chimpanzee in ability to use and fashion implements and operate mechanisms, is superior to it in other modes of behavioral adaptation and may indeed possess a higher order of intelligence than any other existing anthropoid ape."

Today, more than fifty years after Yerkes made his remark, Koko's performance bolsters his intuition.

CHAPTER 4

Tumultuous Times

The attempts to communicate with apes have been marked by controversy from the time of the first successful attempt to converse with another animal. The problems are twofold. First of all, the idea that language is what separates man from animal is enormously important to the way we view and act in the world, and is not the type of concept that can be cast aside blithely. Secondly, it is one thing to seem to converse with another animal, but it is quite another to be able to prove that the animal's responses are not simple mimicry or trickery. After all, stories about "talking cats" or "talking dogs" inevitably turn out to be whimsy. Why should anyone take the notion of "talking apes" any more seriously? The difference is that the work with apes has involved experiments designed in such a way as to isolate different aspects of language and to rule out alternative explanations of what the ape is doing when it uses the language. Such rigor was necessary at the beginning of these experiments if the idea of conversing with an ape was to be perceived as anything other than wishful thinking, and that rigor has been necessary throughout Project Koko.

In July 1972, when I began to work with Koko, there was already a body of literature that suggested vastly greater capacities for language in the great apes than the fewer meager spoken words several previous experiments had produced. This was chiefly due to Gardners' work with Washoe.

It was the Gardners' insight to design an experiment that separated the concept of language from speech. The subject of the Gardners' experiment was Washoe, a wild-born female chimpanzee whom they began training in June 1966. The Gardners began their work at a time when scientists were citing an elaborate attempt by Keith and Catherine Hayes to teach spoken language to a chimp named Viki as conclusive evidence that language was the critical ability that separated man from the other animals. Viki had proved almost the peer of normal human children in performing a number of perceptual and analytical tasks, but she was never able to speak more than five or six words, and she uttered these simple words only with great difficulty. When the Gardners saw films of Viki, they watched with a different eye from those who assumed that Viki's limitations were due to mental inadequacy. They noted that the chimp was almost

intelligible without the soundtrack, and that she consistently made characteristic gestures when she tried to speak. Moreover, Viki learned to say only words like "cup" which she approximated by reproducing the unvoiced "c" and "p"; she was never able to voice the "u." The Gardners began to wonder whether Viki's problem was physical rather than mental. They decided it would be worthwhile to test a suggestion made by Robert Yerkes fifty years earlier - that sign language might be the most productive medium for establishing communication with the apes.

Because they were pioneering, the Gardners had no precedents to guide them. They were not sure which teaching method might be the most productive with a chimp, and they were not sure what language to use - an existing sign language or a gestural language they might invent. They chose to teach Washoe Ameslan because it was well known and had been studied, and because it would allow them to compare Washoe's performance with that of deaf children and normal speaking children.

After experimenting with various methods deriving from different theories of language acquisition, they settled on an instructional method called "molding," in which the teacher takes the subject's hands and forms them into the proper configuration for a sign while the child or chimp looks at some representation of what it signifies. The Gardners were not doctrinaire about this method, however; if Washoe picked up a sign through imitation, or through the progressive "shaping" of her gestures, the Gardners would exploit these opportunities as well.

By the end of only twenty-two months of training, Washoe had acquired 30 signs that she used "spontaneously and appropriately." Her vocabulary was four times larger than the largest acquired by any other ape in the experiments using spoken language.

Because the Gardners were conducting these experiments at a time when the behavioral sciences were generally hostile to the idea that an animal might learn language, they had to be above suspicion in their methods of data collection and testing. To prevent the possibility of cueing Washoe (inadvertently giving her the answers), they used a method of double-blind testing, in which the tester could see what Washoe was signing but could not see the object that elicited the sign.

Perhaps the clearest evidence that Washoe was something more than a clever mimic was the way she seized on the utility of the language. She invented a sign for bib which the Gardners rejected but which, upon examination, turned out to be the correct gesture in Ameslan.

She also invented a sign for hide that she used to initiate one of her favorite games, hide-and-seek.

It was not only Washoe who was shaking up ideas in the scientific establishment. At about the same time that the Gardners began to publish their findings with Washoe, David Premack, a behavior psychologist from the University of California at Santa Barbara, began to publish the results of his attempt to teach a female chimp named Sarah an invented "language" using plastic tokens placed on a magnetized board.

Given the modesty of the Gardners' published claims for their subject, the response was extraordinary. Their news that one animal had used a human language precipitated a thunderstorm of criticism from many eminent scientists who had already gone on record saying that animals could not learn language. The Gardners had merely presented a list of two-word phrases generated by Washoe and claimed that Washoe's early sentences compared with the early sentences of children of equivalent age. They noted that they fully expected the child to outpace the chimp in language acquisition eventually, and said that they simply wanted to determine at what point this occurred. They were not trying to show that Washoe had mastered language, but only that there was continuity between animal and human communication.

If the Gardners were trying to show that in some ways Washoe communicated like a child, they were criticized as though they had said that the chimp was the next Mark Twain. Immediately after the first publication of their findings in 1969 in *Science*, rebuttals began to appear, written by the most distinguished names in the behavioral sciences. Roger Brown, one of the first psycholinguists; Erich Lenneberg, another distinguished psycholinguist; geneticist Theodosius Dobzhansky, went out of their field to attack the Gardner's findings. It is unclear whether Bronowski left his field, because he had so many.

Bronowski and Ursula Bellugi, a distinguished psycholinguist who was then a graduate student, wrote a brilliant exposition about the structure of the sentence and then offered a laundry-list of reasons why Washoe did not have language. This list - Washoe did not ask questions, she did not say no, she had no sense of word order - like so many of the criticisms leveled by others, turned out to be premature. Bellugi subsequently took back her criticism - indeed, many of the early conclusions were later recanted. It is ironic that long after Bellugi revised her early criticisms of Washoe, other scientists were still citing her original article in support of their skepticism of the sign language experiment.

The Gardners' response to these objections was merely to ask: How can one be so sure that Washoe does not have language when there is no agreement among linguists about what language is or when a child can be said to have it?

The fact that so many eminent scientists hastily dismissed the language experiments with chimps was not simply because they had earlier written that only man had language, and that they hated to admit they were wrong. Rather, their reactions illustrated a basic truth about the nature of scientific change: Science can discover that something is wrong with its guiding principles (for instance, the ancient idea that the earth is the center of the universe) only if scientists are passionately and rigorously dedicated to those erroneous principles. Using those principles, the scientist will pursue investigations into the unknowns of his science. If something is wrong with those guiding principles, his research will at some point turn up anomalies (eccentricities in the orbits of the planets, for instance) that either cannot be explained by the principles of the science or might be more economically explained by another set of principles (by installing the sun as the center of the solar system). When the alternative explanation of the anomaly appears, science does not then change by mass conversion. Rather, adherents of the old idea and the new idea exist side by side for a time, until ultimately those holding the old idea die out and are succeeded by scientists educated under the new view of things. Thus science proceeds by revolution. This in a nutshell is the model for scientific change proposed by Thomas Kuhn.

Although Kuhn based his model on the so-called hard sciences such as physics and biology, it would seem to explain the somewhat confusing situation that surrounds the language experiments with animals. The difference is that in the behavioral sciences the lines between philosophical and scientific principles are much more blurred. Not only has the idea that man is the only animal capable of language been argued by scientists, but it also appears in the Bible, in interpretations of the Bible, and throughout Western history in different philosophical tracts. The notion that only man has language is bound up with arguments involving our rights to experiment with or harvest natural resources, and indeed forms the basis for the development of Western civilization. Therefore, it is hard to find an aspect of life in a modern society that does not at some level touch on the question of whether or not language separates animal from man. Since the argument for human uniqueness that was threatened by the anomaly of the Gardners' success with Washoe is one of the most pervasive tenets of modern life, it should not then be surprising that there was a large

constituency of eminent scientists who were committed to the notion that animals cannot learn language to keep upstarts like Washoe and Koko out of language's exclusive club. Nor should it be surprising that this debate continues fifteen years after the first animal conversed with a human in a human language.

The curious thing about the devotion to the anti-evolutionary notion of man's language uniqueness is that some of the great evolutionary scholars of our times sedulously adhere to it. In a world in which we see graceful continuities linking us anatomically and behaviorally to the rest of the animal kingdom, language theories require us to accept an awkward discontinuity when we consider communication. All the Gardners were asking was why, if there is continuity in every other aspect of anatomy and behavior, should there not be continuity in communication. The answer turns out to have to do with a lot of things other than language.

This was the turbulent climate of the behavioral sciences in which Project Koko began. I could profit from the methods and experience of the Gardners and, because of them, did not have to refight the initial battles for credibility. However, a significant number of behavioral scientists still considered these interests odd, if not heretical. And when some Stanford psychology professors noted that I was enjoying myself, their attitude was "When are you going to stop fooling around with gorillas and start doing some serious work for your thesis?"

CHAPTER 5

Koko's First Words

Koko first began to show signs she understood the significance of the strange gestures she was constantly witnessing as early as the second week of Project Koko. On July 25, before Koko had been taught any signs through molding, the volunteers reported that she made gestures that resembled the *food* and *drink* signs several times during the morning before I arrived. I was reluctant to accept this as significant. Koko was not making the signs spontaneously in my presence, and I had no reason yet to accept that she was learning by observation alone. (In retrospect, I believe that Koko probably did try to make these signs; she has subsequently surprised me often by making signs she has learned only by observation, without any active instruction.) The volunteers continued to report what seemed to be signing attempts, and I began to notice that Koko was starting to use "natural" signs observed in wild gorillas, such as *gimme*, which looks like a beckoning gesture.

Over the next two weeks, Koko continued her spontaneous approximations of signs, but to me they seemed coincidental, random, and unintentional. With all her fidgeting, I wondered whether any of our intent was getting through. On August 7, we began a formal routine of active instruction. My assistants and I used every opportunity that arose during the day to teach Koko *food*, *drink*, and *more*. Rather than hand her her bottle as a matter of course, we would first hold it up and let her see it. If she responded by signing *drink*, we'd give her the bottle. If she made no response, we'd sign, *What's this?* If that still elicited no response, we'd mold her hand into the sign for *drink*. I also asked the zoo volunteers to include some signing in their daily caretaking routine when my assistants and I were absent.

Only two days into this training routine Koko said her first word. On August 9, she consistently responded with close approximations of the *food* sign when I offered her tidbits of fruit. Most frequently she put her index finger to her mouth, but she also made the sign correctly - putting all the fingers of one hand, held palm down, to her mouth. As it dawned on me that for the first time she was consistent and deliberate in her signing, I wanted to jump for joy. Finally she seemed to have made the connection between the gesture and the delivery of food, to have discovered that she could direct my behavior with her own.

I praised Koko profusely and seized every chance to get her to sign *food*, showering her with treats in the process. Whenever she reached for some food, I would prompt her by signing *food*, and almost every time she responded. I made sure that she realized she was supposed to ask for things by name by pushing her hand away and signing *no* when she did not make the sign. On several occasions Koko signed *food* without any prompting on my part. After her nap I gave Koko another twenty or so opportunities to sign *food*, and she responded incorrectly only toward the end of the afternoon, by which time the stuffed gorilla had no interest in food whatsoever.

I could not wait to share the news of Koko's breakthrough with Ron and my friends in the Psychology Department at Stanford. Koko too seemed to realize that something exciting was occurring. She was agitated all day, and at one point during the afternoon, she put a bucket over her head and ran around wildly.

Although Koko did not immediately go on to ask the names of other objects, she did attempt to extend the use of her new sign to other situations the next day. She repeatedly used the sign as she watched a volunteer removing discarded food while cleaning her (Koko's) room.

Once Koko made the association between her hand gestures and the objects they represented, she quickly learned the words *drink*, *more*, *out*, *dog*, *come-gimme*, *up*, *toothbrush*, and *that*. Barely into the second month of training, she moved from one-word expressions to two-word combinations - somewhat more quickly than Washoe had. Washoe's first reported combination occurred in her tenth month of training, when she signed *Gimme sweet*. Koko, on the other hand, signed *Gimme food* on August 14, 1972, but because the *gimme* sign in this case might have been a natural reaching motion that Koko combined with the sign for *food*, I couldn't accept her gesture as a legitimate two-word combination. However, before any doubts about Koko's precocity in combining could arise, she followed up by signing *Food drink* eleven days later. She used this to describe her formula, a mixture of cereal and milk. About a month later, Koko said, *Food more*, to ask for more fruit during a teaching session.

In all, during the first two months, Koko used about 16 different combinations, most of which were limited by her small vocabulary to requests for food or drink: *More food*, *Drink there*, *More drink more*, *There mouth*, *mouth-you there*, and *Drink more food more*. I accepted about one-third as legitimate expressions of semantic relations.

One of the early criticisms of Washoe later refuted, was that she did not ask questions. By the third month - September - Koko began to

ask questions as well, although she would not phrase them the same way chimps did. Washoe, Lucy, and other sign-language-using chimps were taught to make the sign *question*, which is to simply draw a question mark with the forefinger in the air in front of one's body. Instead of this, from the outset Koko spontaneously used eye contact and gestural intonation to phrase questions, a form that is considered legitimate in Ameslan.

I first noticed it on one afternoon in early September. I was blowing on the window and urging Koko to draw in the mist. After I demonstrated, she did. Then she pointed to my mouth and touched it with her index finger while looking into my eyes. I assumed she was asking me to blow again, and I enthusiastically complied. Soon she tried making her own fog by putting her mouth close to the window, opening it, and extending her tongue slightly, almost licking the window. She succeeded in creating a bit of a mist and drew in it with her finger. Later that day she even more closely approximated my fog making by adding the *hah-hah* sound I made when blowing on the window.

A week later Koko made a more elaborate request. As a couple with an infant approached the window, Koko pointed to the glass, then to her mouth, then to my mouth, and then to the glass again. She immediately repeated this same sequence and looked into my eyes. Surprised and fascinated by the complexity of her request, I took a few seconds to guess that she wanted to play the fog-blowing game. I huffed a mist and she drew in it. Then Koko again tried to make her own fog by putting her mouth and tongue to the window.

In addition to making requests, Koko began to give an interrogative cast to signed phrases. By cocking her head, raising her eyebrows, and maintaining eye contact, she turned *There food* into a question as she was being carried off to the nursery, and used the same expression to ask *You there?* while pointing to the glass window.

As Koko's language skills developed, so did her physical coordination and mental sophistication. In October when she was fifteen months old, her motor skills were rapidly improving and her perceptual abilities becoming very sharp. She figured out how to turn on the kitchen faucet to get herself a drink, made serious but uncoordinated attempts to return the spoon to a container of yogurt in order to feed herself, and manipulated four wooden sticks simultaneously in play.

As much as she enjoyed our dexterity exercises, however, she could not be tricked, even by Ron's clever schemes, into contacting objects she feared. Once Ron attached a rubber spider Koko hated to a large plastic bead with a clear fish line. While I worked on the signs *dog* and

baby with Koko, Ron placed the bead under the door to Koko's room, hiding the spider out of sight around the corner. Koko saw none of the preparations. When she noticed the bead, she went over to it but looked under the door before pulling on it. The spider came into view, and she jumped back. Ron hid the spider again and Koko pulled on the bead twice more, recoiling both times the spider emerged. After this she batted the bead away when it was presented.

This same day Ron distracted Koko during a feeding session by curling his tongue. She watched him intently through the screen mesh partition in her room and started moving her tongue around in her closed mouth. When Ron left, Koko pounded on the screen until he returned to repeat the performance. Later Koko did something simple but somehow very touching. She took me gently by the hand and led me around her room, pausing frequently to adjust the position of our hands.

If Koko's dexterity was improving, there were still significant limitations on her physical capabilities for signing. A gorilla's hands are somewhat different from the average child's. They are bigger, of course, but they are less well organized for precise motor tasks than ours. The thumb is smaller and placed farther down the hand and away from the rest of the fingers than a human's is. Moreover, the gorilla's precise motor control over its hands, while considerable, is less well developed than ours. This means that certain signs are difficult for Koko to form. In these cases either she will adapt the sign herself, or we will invent a variant for her. For instance, *water* is made by touching the finger-spelling of the letter "W" to the signer's lips. Since Koko cannot make a "W" with her hands (her thumb won't reach her little finger), she will touch the side of an extended index finger to her chin. Similarly, *sand* and *purple* are physically impossible for Koko to articulate because of the small size of her thumb.

Until age four, Koko had trouble executing signs made away from the body, which was true of Washoe as well. Perhaps it was because signs made by bringing hands into contact with the body are better grounded or oriented than those made in the air. Both Koko and Washoe acquired touch signs more rapidly than non-touch signs, although there is no conceptual difference in signs made away from the body. Koko even tried to convert non-touch signs into touch signs by making them on the body rather than in front of it. *Finished*, for instance, is made with both hands out in front of the body, about shoulder width apart. The hands are held vertically, thumbs up and palms facing the body, and shaken. Koko used to make the finished sign by shaking her hands against her chest. Similarly, the sign *milk*

involves holding one fist out in front of the body and then squeezing, as if milking a cow. Koko knocked her chest with her fist to say *milk*. (Now, however, she articulates both signs properly.)

Another curiosity of Koko's signing, probably also related to her preference for signs that make contact with the body, is her habit of making motion signs (such as *long*) starting close to the trunk of the body and moving away rather than the other way around. This reversal has been noticed in autistic children as well.

Not all of Koko's variations, mistakes, and inabilities stemmed from physical limitations. In trying to sort out physical from intellectual influences on her signing ability, I saw that she often made common "baby" errors. Deaf infants use a form of baby talk which may invert the motion or simplify the form of a sign. When babies are learning a sign, they have to generate the mirror image of what they are looking at. Many babies do not complete this adjustment for some time. The sign *bird* is made by forming the index finger and thumb into a configuration somewhat like a bird's beak and then placing the hand beside the mouth pointing outward. Koko makes this gesture with the fingers pointing toward the mouth.

Another important influence on Koko's growing signing ability was simply her motivation. Both Washoe and Koko quickly learned signs for objects or actions they desired. Washoe picked up *lollipop* without direct instruction, and Koko similarly learned *swing* and *berry* by imitation within minutes. On the other hand, she took months to pick up the sign for *egg*, a food she dislikes.

Koko was often sloppy in her signing and would elide one sign into another, or reduce a gesture to its barest skeleton, but in this she was not unlike fluent signers in Ameslan. When two fluent signers are talking, they may frequently take some of the same shortcuts that Koko did. Anyone will recognize that this is the case with spoken language as well. Few people clearly enunciate grammatically precise English. In fact it sounds strange when you hear it. Rather, what are called paralinguistic phenomena - such as cadence, intonation, gesticulation, and stock abbreviations - bear a large measure of the communicative burden. A conversation between two people who know each other well can sound like a meaningless series of mumbles and monosyllables.

Koko's vocabulary was growing at about the same pace as Washoe's - one new sign learned each month - for the first year and a half. At the end of eighteen months, Koko had acquired 22 signs, about the same as Washoe, who had acquired 21 in the equivalent period. When she

was three years three months, she had emitted 236 words, of which 78 met our criteria for acceptance.

By then Koko was regularly using such words as *love, hot, baby, time, necklace* (which she learned when we had to start using a leash on walks so she wouldn't dart into traffic), *small, blow, wiper* (meaning a cloth or paper towel), *pillow*, and *bread* (acquired when we started feeding her peanut butter sandwiches for non-meat protein). Her progress was heartening, not only because it compared favorably with Washoe's but also because it belied the gorilla's image as intellectually inferior.

Although Koko was constantly producing new surprises in her signing, it was when I reviewed her earlier signing performances that I was most struck by her increasing facility with the language. Our conversations six months into the project, when Koko was one-and-a-half, were definitely rudimentary:^{*}

PENNY: *Want up?*

KOKO: *Up.* (I pick Koko up.)

PENNY: *Come here, Koko.*

(Koko comes over to me and we return to the nursery from the back storage area. I am holding a rubber man doll Koko wants.)

PENNY: *This is a man.* (I mold her hands to form the sign *man*.)

KOKO: *Food out more.*

PENNY: *Man.* (Again, I mold *man*.)

KOKO: *Drink.*

PENNY: *Man.* (Again I mold the sign.)

KOKO: *Out.*

(Again I mold the sign. After a few more moldings I hide the man doll under my smock. Koko looks for the doll.)

PENNY: *Where is the man? Where?* (Koko brushes dirt off the bottom of my shoe.) *That dirty.*

By age two-and-one-half, Koko's signing was much more frequent and varied. On November 1, 1973, for instance, we had another

* In this and other conversations in the book, the human statements are made in both voice and sign language simultaneously, except where otherwise specified. As stated earlier, signed words are always indicated by Italics. Thus, in the statement, "Where is the man?" all four words were spoken, while *where man* was simultaneously signed. A hyphen between two signs indicates either that the two words were signed simultaneously (such as *go-there*) or that the sign translates to two different words in English (such as *frown-sad*).

conversation about going out. This one began with my spinning Koko around as she lay on the counter.

KOKO: *Tickle.*

(I sign *tickle* on Koko's hand.)

PENNY: *What do you want?*

KOKO: *Out key.*

PENNY: *What?*

(Koko turns and looks out the window. I get out my keys.)

KOKO: *Open sweater key.*

(The sweater Koko wears on outings is kept in a locked cupboard. I hold up the keys.)

KOKO: *Key.*

(I give Koko the keys.)

KOKO: *Key key.* (She shakes the keys up and down.)

PENNY: *Koko plays with keys.* (As she plays, I bring some cottage cheese.) *Cheese for you. Give me the keys, Koko.*

(Koko hands me the keys, then pushes me around and climbs onto my back. I carry her around piggyback for a minute, then drop her off at the counter by the cottage cheese.)

PENNY: *Sit here.*

KOKO: *Out nut bean key.*

PENNY: *Cheese.*

KOKO: *Bean.*

(I mold the sign *cheese*.)

KOKO: *Open.*

(I again mold *cheese*.)

KOKO: *Bean.*

(I give up and give her some more cheese.)

KOKO: *More food.*

PENNY: *Want more?*

KOKO: *Out.*

(I mold the sign *cheese*, and offer her another spoonful.)

KOKO: *My cheese eat ... food.*

PENNY: *More?*

KOKO: *More bean ... white food.*

A year later, at age three-and-one-half, Koko still liked to go out, although by this time her signing had developed to the point where she could be much more explicit in her requests. On this occasion Koko's desire to go out was prompted by the appearance of our adopted cat, KC (for Koko's cat), at the window of the trailer we had recently moved into. I called, "Here, kitty, kitty, kitty," and Koko,

hearing this high-pitched chant for the first time, stared at me in apparent surprise, and then climbed onto my back to get a better look at the cat. Koko took my finger and put it on the door.

KOKO: *Do key do key.*

(I mold the sign *open*.)

KOKO: *Open.*

(I open the door and take her piggyback down the hall to turn down the heat. As I do so I mold *ride*.)

KOKO (as we turn around to go back): *Go there.*

When we returned, Koko tore around the trailer for a minute until I caught her and brought her back to the kitchen. She went to her potty and signed, *Cat cat cat cat*. Then she returned to the window to look at the cat, who was in the grass hunting. She signed, *More there*, took my chin in her hand, pointed to my mouth, and signed, *More more there*. Wondering if she wanted me to repeat the call I made to KC earlier, I signed, *More cat say?* She replied, *Cat*. So I again called, "Here, kitty, kitty, kitty," to her apparent delight and satisfaction.

Koko's days at the zoo were not entirely occupied with language training. One memorable diversion was a party we had for Koko on her third birthday. The party began at 6:00 p.m., after Ron and I had spent an hour and a half preparing for the festivities. Naturally, the first thing Koko did was to open her presents. Barbara Hiller had brought Koko a 3-D viewer with animal pictures: Lee White, a volunteer, brought a wicker bed, a shrunken head, and a plastic snake that slithered down a stick; Ron gave Koko a quart-sized red glass; and I brought a volleyball, binoculars, a toy frog, rings, and a Snoopy pinata filled with nuts, candy, and toys. We hung the pinata from the ceiling of the trailer. Koko signed *look* when she took up the binoculars that converted into drinking flasks.) Failing to detach the eyecaps, Koko put the binoculars around her neck and walked around like a field marshal.

The destruction of the pinata was a wild and wonderful event. After knocking it down with one deft leap, Koko tackled it with hands, feet, and teeth. As the candy and nuts spilled out of a hole she made, Koko was overcome by the sudden deluge of such riches. She stuffed the treats into her mouth in a frenzy, eating candy wrapper and all. When miniature marshmallows fell out of the pinata, however, Koko became cautious and nibbled them in tiny bites.

Koko ate her birthday cake decorously with a spoon, but when she got to the last bite, she temporarily forgot her manners and scooped the cake directly off the plate with her mouth. We let Koko stay up late after the party. She was content to sit quietly in her new wicker bed hugging a stuffed gorilla toy as Ron and I ate our dinner.

CHAPTER 6

The Move to Stanford

If I was elated at Koko's breakthroughs during the early days of the project, my enjoyment was tempered by the frustrations and crises of pursuing my work in front of gawking visitors. Although at first I had no idea how long the project was going to last. I still wanted to Koko out of her glassed-in cage and into quarters that were more tranquil and private. Mr. Reuther gave permission for us to move Koko to a trailer, if we could find one that fit next to the gorilla grotto. So Mr. Reuther and I went trailer-shopping in San Jose. After visiting several dealers we found a used, partially furnished ten-by-fifty-foot mobile home in the want ads. It was over ten years old and a bit run down, but at \$2,000 it was a bargain. In the fall of 1972 the trailer was installed safely out of view, next to the zoo's office trailer but unfortunately close to the track for the zoo's miniature steam engine. It took some time to adapt Koko to the trailer. Each day, if the weather permitted and the trailer wasn't being used for other animals, I would walk Koko from the nursery to the trailer to get her accustomed to it. If I was not there in the mornings, an assistant would accompany Koko. One assistant, who was somewhat overweight, occasionally showed up at the nursery perspiring heavily and sans gorilla. Koko, at first frightened by the new trailer, would escape and lead him on a merry chase back to the nursery.

Koko's gradual adaptation abruptly speeded up one day in June 1973 when she broke the glass window in the nursery kitchen area. A woman had knocked on the glass and Koko had knocked back a little too hard. Worried that Koko might repeat this performance, Mr. Reuther ordered her to move to the trailer full time, whether she was adapted or not.

This news seemed to me a fitting part of the miserable day. I had arrived at my office to discover that Koko had bitten her good friend Barbara Hiller on the hand. Then, in the mail I received word from a foundation that they had no funds for my project, along with a huge bill from Master Charge because of a computer error. On the way back to Stanford from the zoo I was looking forward to a relaxing dinner out with Ron, a respite from the day's tensions, when I received a speeding ticket. At dinner, the waitress spilled wine over my dress as she was about to serve the main course. My mood was not improved when I saw that the restaurant discriminated against women in the

size of its portions. (I eat one *large* meal a day.) Finally when I got home I discovered the heater had malfunctioned in my pet iguana's cage and nearly roast him alive.

Still, it was a good thing to move Koko to the trailer. At the nursery she had been learning not only language but also the basic skills of breaking and entering. Or rather, breaking and exiting, since it was a jailbreak that she had in mind. Even at her tender age, she had learned to work padlocks and twistlocks loose, and once she nearly got out the rear door of the nursery.

The trailer had a kitchen, an adjoining living room, and a hallway that led to a small bedroom, bathroom, and "master" bedroom. My assistants and I took turns staying in the large bedroom overnight when necessary. Like many small children, Koko began having nightmares after moving. She would scream, wake up, then fall back to sleep, or sometimes keep on shrieking once she awakened. When this happened, whoever was spending the night picked her up, comforted her, gave her some warm milk, and then put her back to bed.

After Koko became accustomed to her trailer, we continued to take her walks around the zoo. Occasionally we encountered a friendly mounted policeman. Koko was afraid of his horse, but liked the policeman. One day the policeman mimicked the sound of a galloping horse for Koko's benefit. When we returned to the trailer I heard Koko imitating the clicking noises the policeman had been making. Since gorillas are not supposed to be able to imitate sounds at all, I was reluctant to believe my ears. Subsequently, though, Koko has imitated other unvoiced noises.

Because the trailer was carpeted, we stepped up our efforts to toilet-train Koko. By now we had many more successful uses of the portable toilet than mistakes, and there was a pattern to the failures indicating that many of them might have been intentional. By July 1973, the great proportion of Koko's lapses occurred when she was locked up alone in the trailer at night, and were probably produced by the anxiety of being left alone. It is also remotely possible that Koko, noting our interest in her use of the toilet, figured that she might get us to stay with her by using it correctly only when accompanied by me or one of my assistants.

Koko's basic nature is fastidious. She has always hated stepping in dirt: outdoors she will insist that she be carried over puddles-if she can find someone to carry her-and indoors she will scrub and clean her quarters with a vigor that suggests more than mere imitation.

Interestingly, the work *dirty*, which she first used at about age three, and which we use to refer to her feces, became one of Koko's favorite insults. Under extreme provocation she will combine *dirty* with *toilet* to make her meaning.

Even long after Koko had gotten used to sleeping alone, she periodically failed to use her toilet, perhaps out of retribution or as an attempt at manipulation. On the other hand gorillas, unlike chimps, do foul their nests in the wild, and so it is difficult to claim definitively that her nocturnal misadventures were manipulative or vindictive. Koko is, after all, unusually delicate on the subject of cleanliness, and it did not take long for her to become fully toilet-trained.

By the second year of Project Koko, my interest in Koko and that of the San Francisco Zoo had diverged to the point that some sort of conflict became inevitable. When I began the project it was with the understanding that at some point Koko would be reunited with the rest of the gorilla colony. The zoo felt a responsibility to breed and perpetuate this endangered species, and at first I accepted their logic that this could only occur if Koko was raised with other gorillas. Moreover, I shared the common belief that gorillas and chimps become unmanageable at about age six. My expectation was that I would work with Koko about as long as the Gardners had worked with Washoe-four or five years-and then return Koko to the gorilla grotto before she got out of hand. However, quite early in the project I began to wonder whether gorillas really do become unmanageable or whether environmental or other factors had made them appear so. Moreover, I began to wonder whether it was really necessary for Koko to go back to the gorilla grotto in order for her to have a baby. Many things contributed to these changing thoughts.

For one thing, I knew that a number of people had continued to work with adult gorillas. Carroll Soo Hoo had romped with full-grown gorillas; I thought if this man-who was smaller than I was-could get along with adult gorillas, then so could I. I had also visited the zoo in Basel, Switzerland, the December after the project began and saw a young male keeper in with several full-grown females and their offspring. He had no problem disciplining an adult and playing with the infants. And, while I did not disagree with the zoo's objective of breeding Koko, I thought it would be possible to breed her without returning her to the gorilla grotto. If we could provide her with another ape companion, I felt she could learn how to get along well enough with apes to mate.

Moreover, by now something more than cold objectivity was influencing my thoughts about Koko's future. Quite simply, she began to get to me. Koko was not just the subject of an experiment, she was a baby, and, I quickly discovered, as dependent and affectionate and engaging as any human infant. At first when Koko sensed I was about to leave, she would cling so fiercely that I literally had to pry her off before I could depart, and she sometimes left black and blue finger marks on my arms.

Caring for entailed most of the joys and stresses of parenthood. And like a parent, I was endlessly fascinated by her development and charm. She cooperated with chores, assisting in cleaning and handing me items on request. She imitated my every move, from talking on the phone (Koko even opened and closed her mouth and huffed and screwed up her face) to grooming her fingernails when I did mine. She initiated hide-and-seek games in which she would "hide" under a folding chair while I searched in cupboards and the oven, calling her name until finally she charged out laughing. Koko also continually sought and found trouble in various forms-dismantling her toilet, removing Formica from counters, setting off the timer on the stove, unraveling rolls of paper towels across several rooms, and feigning a hub while chewing up the tape-recorder microphone I wore attached to my smock. But any irritation would be dispelled when she'd wrestle with and kiss her dolls with loud smacks, tickle my ears, or make me a part of her bedtime nest by arranging my arms around her, gently pushing my head down into place, and lying down and cuddling.

As her vocabulary grew and Koko began to use words in ways that revealed her personality, I began to recognize sensitivities, strategies, humor, and stubbornness with which I could identify. It was the realization that was dealing with an intelligent and sensitive individual that sealed my commitment to Koko's future. My knowledge of Koko's vulnerabilities made the prospect of returning her to the gorilla grotto unimaginable. By the time Koko was three, I was afraid that it that happened the trauma of separation would kill her.

Finally, I should also say that I was proud of Koko. The notion that another animal can acquire language is somewhat abstract until you see it happen or, in my case, make it happen. Then the world changes. My ambition to compare Koko's performance with Washoe's up to age four was only partly achieved, and so far Koko seemed to be matching-and in some ways exceeding-Washoe's performance. I desperately wanted to see how much Koko could learn, how far she would take her knowledge of language. But mostly, I wanted to

continue to talk with her and be with her. The looming expiration point of my agreement with the zoo became an intolerable prospect.

The zoo had worried about the possibility that Koko might become too attached to me and humans in general ever to readapt to the grotto, but I doubt that they considered the possibility that I might become too attached to Koko to return her without a fight to what I believed was a potentially harmful situation. Actually, once it became clear that Koko was acquiring language, there was a division of opinion among zoo officials and handlers about what would be the best future for the gorilla. Some worried that Koko was getting too humanized and would become unmanageable as an adult. Other realized that Koko was involved in something extraordinary, and several, principally zoologist Paul Maxwell, made efforts to help me continue my work unmolested.

However, my feelings about the life of a zoo animal were somewhat hardened by the experiences I shared with Koko behind bars. The zoo, under a new interim director following the departure of Mr. Reuther, decided to put Koko on display each day for at least a couple of hours because she was, after all, a zoo animal. And so for several months, Koko and I and whoever else was working with us spent daily periods on exhibit behind a chain-link fence. Koko did not seem to mind this much as long as we were with her. I, on the other hand, hated it. The fence let in all the raucous sounds of passers-by, and was not effective against the small objects that the more insensitive spectators would throw at us. I also worried about the danger of pneumonia presented by the sudden temperature change from Koko's heated trailer to the chilly and often foggy cage. At first I dressed Koko in a sweater, but officials wanted to put a stop to this on the ground that gorillas do not wear sweaters in the wild. This argument seemed absurd to me, since neither do wild gorillas spend their time locked up in cold, confining, prisonlike cages. After a few weeks in this cage, the glassed-in quarters of the nursery began to look quite cozy in comparison.

I began to try to think of alternatives that would satisfy the zoo's desires to breed Koko without terminating the language project and subjecting Koko to the stresses of zoo life. One of my ideas was to find a young chimpanzee as a temporary non-human companion for Koko. It seemed to me that it would be easier to find a chimp than another young gorilla, and that a chimp as a friend would be sufficient reminder to Koko during her formative years that she was an ape. This idea fell flat with the powers at the zoo. Then, in the fall of 1973, Paul Maxwell suggested that I get in touch with Marine World in Redwood City, which had a good-natured young male gorilla named

Kong who was not much larger than Koko. I grasped at this suggestion as the only satisfactory alternative to Koko's reintroduction to the gorilla colony, and arranged for Koko and Kong to visit each other. Although the chemistry between Koko and Kong never progressed to biology (both were much too young to breed), their brief liaison did serve the purpose of getting Koko out of the zoo and into her somewhat more tranquil quarters at Stanford. This was one positive thing that came out of that confusing period in the project.

At this point some zoo officials, already worried that Koko had become too estranged from her own kind to be reintroduced to the group, talked of "surplussing" Koko. This meant lending or selling her to another zoo. Once Kong was proposed as a companion for Koko, the idea of selling Koko to Marine World was batted about for a time. If nothing else, this indicates the uncertainty that clouded Koko's future.

Ironically, what most facilitated Koko's move to Stanford was that once it was agreed Kong was an appropriate companion for Koko, neither the zoo nor Marine World wanted its gorilla to make the long commute to the other facility. Marine World did not want Kong to visit Koko at the San Francisco Zoo because officials there were worried that their valuable and rare charge might pick up a stray infection and die. The zoo, on the other hand, worried that an auto accident might occur if Koko were on the road to Marine World every week. As a solution to this impasse I proposed to move the trailer to Stanford, where danger of zoonotic diseases could be more effectively controlled, and where Koko would be only a ten-minute drive from Kong.

At this point I had invaluable assistance from several people. Richard Atkinson, then head of the Stanford Psychology Department, negotiated with Stanford to get permission and find a location on campus for Koko's trailer. Our lawyer, Edward Fitzsimmons, negotiated with the zoo for the purchase price, and Karl Pribram, my original advisor, contributed some of his grant money toward the buying of the trailer.

These negotiations were not without their amusing moments. We discussed several sites for the trailer. One spot we considered ideal was rejected, purportedly because a powerful

administrator did not like the idea of a trailer spoiling his view of the campus. Eventually, we were given permission to locate the trailer in an area for laboratory animals. While to me the area had unpleasant associations with vivisection, it was relatively spacious and secluded.

A final logistical problem was to find funding to pay the zoo for their improvements the trailer, and to pay the cost for operating Project Koko after we were installed. Once again, Richard Atkinson provided invaluable help. He and a biology professor, Donald Kennedy, who is now president of Stanford, lent their considerable reputations to obtain a grant from the Spencer foundation that covered a large part of the costs of the project during its first two years at Stanford. Now all that remained was to convince Koko, the object of this ongoing custody battle, that the move was a good idea.

Moving day was September 19, 1974. The weather was foggy and somber. To lessen the trauma of the coming dislocation, I gave Koko four teaspoons of Benadryl. Unfortunately, Koko was so keyed up that this mild tranquilizer had no evident effect. While Ron and I waited for the workmen to prepare the trailer for the move, Koko chased passing peacocks. We had a hard time keeping her in one place. Our actual departure was rather solitary, reflecting the strained feelings that had surfaced during the dispute over Koko's future. Only John Alcares, the gorilla keeper, came by to wish us good luck.

We left for Stanford about 10:15 a.m., after the trailer was safely on its way. Ron, Koko, and I got the car to begin the drive, and Koko, whose favorite pleasure is a drive in my car, happily signed *Go, go*, and then as we continued around Lake Merced toward the freeway, *Go chase up*. After thirty minutes, however, Koko began to get anxious, reverting to her pre-toilet-trained ways and making the last part of the ride less pleasant than the first.

We arrived at Stanford well ahead of the trailer. To help abate Koko's mounting anxiety, we spread a tarpaulin in a shady spot near the University Museum, which adjoins the lab animal area. Koko decided that she had had enough of this outing, and signed *Go home*. She also signed *Go me Kate key* (Kate was here teacher, one of my assistants), perhaps to express her desire to return to the safety of her trailer.

When the trailer arrived an hour later, Koko was moved into another fit of expressiveness. She signed *Go home*, and then punctuated this statement by making repeated lunges for the trailer. It took some time to install the trailer, and so we had to restrain her. Once the trailer was ready for Koko to go inside, it still lacked electricity. Her anxiety increased when she heard the strange noises of buses and roosters and other activities that were part of her new surroundings. During that first night Koko awoke repeatedly and cried, and I stayed

with her every night for the next month until she became sufficiently accustomed to the sounds of her new home.

Kong did not work out as a companion for Koko, mainly because his visits were not frequent enough for the two to form a relationship. We had expected that Kong would be brought to visit Koko at least once a week. It worked out that the two gorillas saw each other no more than once a month. One problem was that Kong was getting big and Marine World was having difficulty handling him. Moreover, he was not learning any tricks, a fact that comes as no surprise to anyone familiar with the gorilla's distaste for being told what to do.

Eventually, Marine World offered to sell us Kong, but, acting on advice, we decided not to buy him. By the time Kong was offered to us in the spring of 1975 he was adolescent, and I felt that it would be difficult to come into his life that late and establish the dominance necessary to be able to handle him. Eventually, he was purchased by Salt Lake City Zoo. Although Koko and Kong's liaison did not work out, it did get Koko and me to Stanford, where I could concentrate exclusively on the language project.

CHAPTER 7

The Campaign for Koko

Even after the move to Stanford, there still remained the question of who would have ultimate custody of Koko. Shortly after the move, Mr. Soo Hoo asked Ron whether we would be interested in purchasing Koko. Ron immediately said yes, but getting zoo officials to agree to this idea turned out to be a problem. During negotiations over our move to Stanford, Saul Kitchener became the new head of the San Francisco Zoo. He was willing to let us have Koko, but only on the condition that we replace here with another female gorilla. This stipulations posed much more formidable problems than the purchase of Koko, no matter how steep the price turned out to be. Because gorillas are an endangered species, they are not - nor should they be - readily obtainable through animal dealers. Through various contacts, we approached a number of zoos and research centers. There was a seven-year-old female available at Yerkes Regional Primate Research Facility in Atlanta, but Mr. Kitchener turned her down because she was arthritic. Another gorilla was available from the Honolulu Zoo, but Mr. Kitchener felt that those one was too old. Then in 1976 Barbet Schroeder, the film director, put us in touch with an animal dealer in Vienna who was offering an infant female and an infant male gorilla for \$28,000. When an animal dealer offers wild-born infants for sale, one can usually assume that the infants were "harvested" through the gruesome expedient of shooting the mother. In this case the dealer told us that he obtained the two gorillas in Cameroon, and that they were orphaned after natives had eaten their parents. We were in no position to verify this story about the gorillas' provenance, and, ultimately, we overcame our qualms and decided to buy the two. The idea was that we could then give the female to the zoo as a replacement for Koko and keep the male to be Koko's eventual mate.

This left the simple matter of raising \$28,000 to pay for the two infants. Together Ron and I had enough money to put down payment on one gorilla. We still had a shortfall of about \$21,000. At this point the media proved invaluable. Since the beginning of the project, my work with Koko had attracted a considerable amount of media interest. I would like to think that this attention derived solely from the awesome import of being able to converse with another animal, but I have had to accept that part of it centers on the supposed drama of a woman working with a "ferocious beast." In any event, during the

period when we were trying to raise the money to buy the two baby gorillas, I would mention Koko's precarious future to the reporters who requested interviews. The local press took up my problems as a cause.

The two baby gorillas arrived on September 9, 1976. Their names were listed as King Kong and B.B, (short for Brigitte Bardot). We took it as our first obligation to rescue them from their unfortunate names. King Kong we renamed Michael, but we never got a chance to rename poor B.B. The rigors of her travels proved to be too much for her frail constitution, and in spite of our desperate efforts to nurse her back to health, she died of pneumonia within a month of her arrival.

On March 9, 1977, the San Francisco Examiner published an article about the uncertainties of Koko's future. The article reflected the sense of urgency I felt about Koko's future, and quoted me accurately as saying that I felt Koko would die if she were returned to the gorilla grotto. It also quoted Saul Kitchener as saying that he had never heard of anything like that happening. (I might point out in retrospect that there were no precedents involving language-using gorillas on which either of us could base our feelings, although I had read several accounts of apes dying or wasting away after abrupt separations from their mothers or caretakers.) The article generated more than \$3,000 in donations toward the purchase of the two infants, and also spurred a "Save Koko" campaign, complete with bumper stickers, that ultimately got national attention. The recipient of the donations was the Gorilla Foundation, a nonprofit organization Ron Cohn and I, with the aid of Edward Fitzsimmons, founded with the idea it would hold trust over Koko, protect her interests, and abet the study and preservation of gorillas in general.

This period was the low point of the project. The problems obtaining the gorillas, the frustrations of trying to keep the object of a two-year search alive, and the grief of poor B.B.'s death almost immediately upon arrival took their toll on my concentration and health. Not only was I getting up several times a night to tend to a sick and dying gorilla, but also during this time I was told that I had either Hodgkin's disease or sarcoid and would need a biopsy from my lung. to quarantine Koko from disease, I had to shower and change after each visit to the dungeonlike infirmary where the animals were being kept. Perhaps the only good news to come out of this period was the discovery that I had sarcoid (a relatively benign disease) and not cancer.

At this time Mr. Kitchener was still inclined to insist that we find another replacement for Koko. However, popular sentiment had reached a point where the then mayor of San Francisco, the late George Moscone, became involved and insisted that the zoo allow us to buy Koko. Kitchener has since said that he would not have permitted the sale without this pressure "from above." Thus in the summer of 1977, nearly three years after the idea was first broached, we were permitted to purchase our "humanized" gorilla.

CHAPTER 8

Koko's Day

Today Koko is still housed in her trailer but it has been moved to the secluded hills of Woodside, California. The structure has been fitted with a number of ingenious wire-mesh barriers and doors which permit my assistants and me to work with Koko without being in direct contact with her - Koko has been known to take advantage of her size when alone with some of the new volunteers. Koko and Michael live within a few steps of my house, so that I can continue the routine of training established over the nine years of Project Koko. That routine consists of a daily mixture of language instruction, review, exercise, meals, and play for Koko and Michael, both separately and together.

I wake Koko up at 8:00 or 8:30 a.m. if she has not already been roused by Michael's antics. Following a breakfast of cereal or rice bread (rice and cereals plus raisins baked into a cake). She enjoys going over both her room and Michael's with a sponge. Often these cleaning sessions end when Koko, seized by some urge, rips the sponge to shreds.

The, some mornings, she sits on a chair before an electric teletype keyboard in the kitchen for a thirty-minute lesson in the production of English. Gorillas cannot generate the sounds necessary to speak, but through this Auditory Language keyboard, which is linked to a voice synthesizer, we have given Koko a device that enables her to talk as well as generate signs. Other mornings we videotape or audiotape or work with flashcards.

These lessons generally end when Koko requests to have Michael in for a "visit." The morning play session lasts about an hour and is filled with tickling, tumbling, wrestling, chasing, and games of hide-and-seek. Only occasionally are there quiet moments during which the two catch their breath, or Koko grooms Michael.

At 10:30 Michael's teacher arrives and Michael returns to his part of the trailer. Koko, an assistant, and I chat in an unstructured manner for the next half-hour. Then, at 11:00, Koko has a banana and milk snack, following which sign language instruction starts. Her teacher introduces new concepts, reviews some of Koko's old vocabulary, and then acquaints Koko with some of the meanings of the "signs of the month." Lessons, spot quizzes, and tests are broken up by meals, snacks, games, and small talk. At 1:00 Koko has a light meal - a

vegetable, meat, juice, and vitamin tablet. Meanwhile I get out materials for the afternoon - crayons and paper, magazines, books, and toys. More play and instruction follow. At 2:00 or 2:30 she gets a peanut butter and fruit sandwich. I return at 3:00 and invite Mike in for another play session, or, if the weather and Koko have both been good, take the gorillas outside for a walk.

At 3:30 Koko enjoys another snack, usually a cottage cheese and wheat germ mixture. At 4:30 she has a dinner of fresh vegetables. Her preferences start with corn on the cob, run through tomatoes, green peppers, cucumbers, sweet or white potatoes, green onions, peas or beans, squash, parsley, lettuce, and end with Swiss chard, spinach, and celery. Occasionally she samples artichokes, asparagus, eggplant, or other gourmet treats. Although she is open-minded about most new foods, she loathes olives, mushrooms, and radishes. Sometimes I dress up spurned vegetables with yogurt. Koko always has a glass of milk with her meal. If she cleans her plate, she gets dessert - either a cookie, Jell-), dried fruit, or cheese and crackers.

After dinner Koko relaxes by leafing through a book, or nests with her blankets and dolls. Some evenings she asks to visit Michael's quarters. Koko especially enjoys romping in his training room and charging up and down the trailer hallway. After a bedtime ritual of toothbrushing - I brush her back teeth, she brushes the front - and moisturizing hands and feet with baby oil, both gorillas settle down at about 7:00 or 7:30.

Koko retires to a bed of three or four plush rugs placed over a large motorcycle tire. She has always been an accomplished nest builder, preferring her own creations to those designed by humans. Before settling on her current model, Koko has experimented with inner tubes, parts of her rubber toys, and other soft materials. I leave Koko with a night dish - a small fruit treat designed to make bedtime more pleasant. Even so, on some nights, Koko whimpers or gives her "whoo-whoo" cry when I leave.