

INTRODUCTION

ANY COUNTRY DWELLER who traverses woods and bush with his dog has certainly become acquainted with a little animal who lies in wait on the branches of the bushes for his prey, be it human or animal, in order to dive onto his victim and suck himself full of its blood. In so doing, the one- to two-millimeter-large animal swells to the size of a pea (Figure 1).

Although not dangerous, the tick is certainly an unwelcome guest to humans and other mammals. Its life cycle has been studied in such detail in recent work that we can create a virtually complete picture of it.

Out of the egg crawls a not yet fully developed little animal, still missing one pair of legs as well as genital organs. Even in this state, it can already ambush cold-blooded animals such as lizards, for which it lies in wait on the tip of a blade of grass. After many moltings, it has acquired the organs it lacked and can now go on its quest for warm-blooded creatures. Once the female has copulated, she climbs with her full count of eight legs to the tip of a protruding branch of any shrub in order either to fall onto small mammals who run by underneath or to let herself be brushed off the branch by large ones. The eyeless creature finds the way to its lookout with the help of a general sensitivity to light

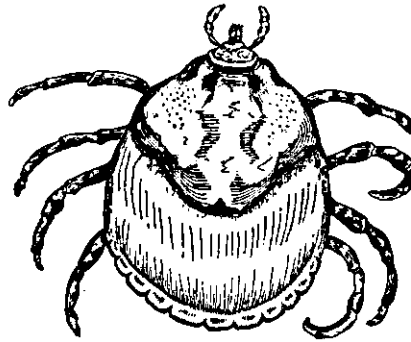


FIGURE 1. Tick

in the skin. The blind and deaf bandit becomes aware of the approach of its prey through the sense of smell. The odor of butyric acid, which is given off by the skin glands of all mammals, gives the tick the signal to leave its watch post and leap off. If it then falls onto something warm—which its fine sense of temperature will tell it—then it has reached its prey, the warm-blooded animal, and needs only use its sense of touch to find a spot as free of hair as possible in order to bore past its own head into the skin tissue of the prey. Now, the tick pumps a stream of warm blood slowly into itself.

Experiments with artificial membranes and liquids other than blood have demonstrated that the tick has no sense of taste, for, after boring through the membrane, it takes in any liquid, so long as it has the right temperature.

If, after sensing the butyric acid smell, the tick falls onto something cold, then it has missed its prey and must climb back up to its lookout post.

The tick's hearty blood meal is also its last meal, for it now has nothing more to do than fall to the ground, lay its eggs, and die.

The clearly known life processes of the tick afford us a suitable criterion in order to demonstrate the soundness of the biological point of view as opposed to the previously common physiological treatment of the subject. For the physiologist, every living thing is an object that is located in his human world. He investigates the organs of living things and the way they work together just as a technician would examine an unfamiliar machine. The biologist, on the other hand, takes into account that each and every living thing is a subject that lives in its own world, of which it is the center. It cannot, therefore, be compared to a machine, only to the machine operator who guides the machine.

We ask a simple question: Is the tick a machine or a machine operator? Is it a mere object or a subject?

Physiology declares the tick to be a machine and says

that one can differentiate receptors, i.e., sensory organs, and effectors, i.e., activity organs, in the tick. These are connected with one another through a control apparatus in the central nervous system. The whole thing is a machine, with no trace of a machine operator.

"Exactly therein lies the mistake," says the biologist. "Not one part of the tick's body has the character of a machine. There are machine operators at work all over the place."

The physiologist will continue unperturbed: "Precisely in the tick, it can be shown that all actions depend solely on reflexes,² and the reflex arc forms the foundation of every animal machine (Figure 2). It begins with a receptor, i.e., with an apparatus that admits only certain external influences, such as butyric acid and heat, and disregards all others.

"The arc ends with a muscle which sets an effector into motion, whether this is the apparatus for locomotion or for boring.

"The sensory cells, which activate sensory stimulation, and the motor cells, which activate the movement impulse, are only connectors which transmit the completely physical waves of excitation, produced by the receptor in the nerves in response to an external impulse, to the muscles of the effector. The whole reflex arc works with the transfer of motion, just like any machine. No subjective factor, as one or more machine operators would be, is apparent anywhere."

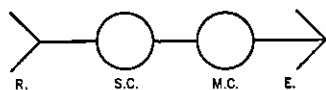


FIGURE 2. Reflex arc: receptor, sensory cell, motor cell, effector

"Exactly the opposite is the case," the biologist will reply. "Everywhere, it is a case of machine operators and not of machine parts, for all the individual cells of the reflex arc act by transfer of stimuli, not by transfer of movement. But a stimulus has to be *noticed* [*gemerkt*] by the subject and does not appear at all in objects."

Any machine part, for example the clapper of a bell, only

operates in a machine-like manner if it is swung back and forth in a certain way. All other interventions, such as, for example, cold, heat, acids, alkalis, electrical currents, it responds to as any other piece of metal would. But we know since Johannes Müller,³ however, that a muscle behaves in a completely different way. It responds to all external interventions in the same way: by contracting. Any external intervention is transformed by the muscle into the same stimulus and responded to with the same impulse, by which its body of cells is made to contract. Johannes Müller showed further that all external effects that hit our optic nerve, whether these are waves in the ether, pressure, or electric currents, cause the sensation of light, i.e., our sight-sense cells answer with the same "perception sign" [*"Merkzeichen"*].⁴

From this, we can conclude that every living cell is a machine operator that perceives and produces and therefore possesses its own particular (specific) perceptive signs and impulses or "effect signs" [*"Wirkzeichen"*]. The complex perception and production of effects in every animal subject can thereby be attributed to the cooperation of small cellular-machine operators, each one possessing only one perceptive and one effective sign.

In order to make an orderly cooperation possible, the organism uses brain cells (which are also elementary machine operators), grouping half of them in differently-sized groups of "perception cells" in the part of the brain that is affected by stimuli, the "perception organ." These groups correspond to external groups of stimuli, which present themselves to the animal subject in the form of questions. The organism uses the other half of the brain cells as "effect cells" or impulse cells and arranges them in groups by means of which it controls the movements of the effectors, which impart the animal subject's answers to the outside world. The groups of perception cells fill up the "perception organs" of the brain, and the groups of effect cells form the "effect organs" of the brain.

If we may, on this account, imagine a perception organ as the site of changing groups of these cell-machine operators, which are the carriers of different perceptive signs, they are still spatially separated individuals. Their perceptive signs would remain isolated if it were not possible for them to coalesce into new units outside the spatially fixed perception organ. This possibility is in fact present. The perceptive signs of a group of perception cells come together outside the perception organ, indeed outside the animal's body, in units that become qualities of the object that lie outside the animal subject. We are all quite familiar with this fact. All our human sensations, which represent our specific perception signs, join together to form the qualities of the external things which serve us as perception marks for our actions. The sensation "blue" becomes the "blueness" of the sky, the sensation "green" becomes the "greenness" of the lawn, and so forth. We recognize the sky by the feature "blue" and the lawn by the feature "green."

Exactly the same thing takes place in the effect organ. Here, the effect cells play the role of the elementary machine operators, which in this case are arranged into well-articulated groups according to their impulse or productive sign. Here, too, it is possible to group the isolated effect signs into units that, in the form of self-contained motor impulses or rhythmically arranged melodies of impulses, produce effects in the muscles subject to them. At this, the effectors activated by the muscles impress their "effect mark" [*Wirkmal*] on the objects that lie outside the subject.

The effect mark that the effectors of the subject impart to the object is immediately recognizable, just like the wound which the tick's mouthparts inflict upon the skin of the mammal on which it has landed. But only the laborious search for the features of butyric acid and warmth completes the picture of the tick as active in its environment.

Figuratively speaking, every animal subject attacks its objects in a pincer movement—with one perceptive and one ef-

fective arm. With the first, it imparts each object a perception mark [*Merkmal*] and with the second an effect mark. Certain qualities of the object become thereby carriers of perception marks and others carriers of effect marks. Since all qualities of an object are connected with each other through the structure of the object, the qualities affected by the effect mark must exert their influence through the object upon the qualities that are carriers of the perception mark and have a transformative effect on the perception mark itself. One can best sum this up this way: The effect mark extinguishes the perception mark.

In addition to the selection of stimuli that the receptors allow to pass and the order of muscles which give the effectors certain potentials for activity, the decisive factors for any action by every animal subject are above all the number and order of perception cells that distinguish the objects of the environment by assigning them features with the help of their perception signs, and the number and order of the effect cells that furnish the same objects with effect marks.

The object only takes part in this action to the extent that it must possess the necessary properties, which can serve on the one hand as feature carriers and, on the other, as effect sign carriers, and which must be in contact with each other through a reciprocal structure.

The connection of subject to object can be most clearly explained by the schema of the functional cycle (Figure 3). The schema shows how subject and object are interconnected with each

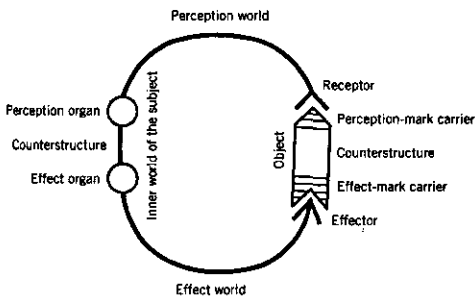


FIGURE 3. Functional cycle

other and form an orderly whole. If one further imagines that subjects are linked to the same object or different ones by mul-

tiple functional cycles, one can thereby gain insight into the fundamental principle of the science of the environment: All animal subjects, from the simplest to the most complex, are inserted into their environments to the same degree of perfection. The simple animal has a simple environment; the multiform animal has an environment just as richly articulated as it is.

Now, let us place the tick into the functional cycle as a subject and the mammal as its object. It is seen that three functional cycles take place, according to plan, one after the other. The mammal's skin glands comprise the feature carriers of the first cycle, since the stimulus of the butyric acid sets off certain perception signs in the [tick's] perception organ, and these signs are transposed outward as olfactory features. The processes in the perception organ bring about corresponding impulses by induction (we do not know what that is) in the [tick's] effect organ which then bring about the releasing of the legs and falling. The falling tick imparts to the mammal's hairs, on which it lands, the effect mark "collision," which then activates a tactile feature which, in its turn, extinguishes the olfactory feature "butyric acid." The new feature activates the tick's running about, until this feature is in turn extinguished at the first bare patch of skin by the feature "warmth," and the drilling can begin.

This is no doubt a case of three reflexes, each of which is replaced by the next and which are activated by objectively identifiable physical or chemical effects. But whoever is satisfied with that observation, and assumes he has therefore solved the problem, only proves that he has not seen the real problem at all. It is not a question of the chemical stimulus of the butyric acid any more than it is of the mechanical stimulus (activated by the hair) or of the thermal stimulus of the skin. It is only a question of the fact that, among the hundreds of effects that emanate from the mammal's body, only three become feature carriers for the tick. Why these three and no others?

It is not a question of a contest of strength between two

objects but, rather, of the connection between a living subject and its object. These take place at an entirely different level: between the subject's perception signs and the object's stimulus.

The tick hangs inert on the tip of a branch in a forest clearing. Its position allows it to fall onto a mammal running past. From its entire environment, no stimulus penetrates the tick. But here comes a mammal, which the tick needs for the production of offspring.

And now something miraculous happens. Of all the effects emanating from the mammal's body, only three become stimuli, and then only in a certain sequence. From the enormous world surrounding the tick, three stimuli glow like signal lights in the darkness and serve as directional signs that lead the tick surely to its target. In order to make this possible, the tick has been given, beyond its body's receptors and effectors, three perception signs, which it can use as features. Through these features, the progression of the tick's actions is so strictly prescribed that the tick can only produce very determinate effect marks.

The whole rich world surrounding the tick is constricted and transformed into an impoverished structure that, most importantly of all, consists only of three features and three effect marks—the tick's environment. However, the poverty of this environment is needful for the certainty of action, and certainty is more important than riches.

As one can see, the fundamental aspects of the structure of the environments that are valid for all animals can be derived from the example of the tick. But the tick has one more remarkable capability that allows us a greater insight into environments.

It is immediately evident that the happy occasion that brings a mammal to pass beneath the branch on which the tick sits occurs most seldom. Even the great number of ticks lying in wait in the bush does not compensate for this disadvantage in such a way as to secure the reproduction of the species. In order to increase the probability that its prey will pass by, the

tick must be capable of living a long time without nourishment. And the tick is capable of this to an unusual degree. At the Zoological Institute in Rostock, they kept ticks alive that had gone hungry for eighteen years.⁵ The tick can wait eighteen years; we humans cannot. Our human time consists of a series of moments, i.e., the shortest segments of time in which the world exhibits no changes. For a moment's duration, the world stands still. A human moment lasts one-eighteenth of a second.⁶ We shall see later that the duration of a moment is different in different animals, but, no matter what number we assign to the tick, it is simply impossible for an animal to endure an unchanging environment for eighteen years. We shall therefore assume that the tick is, during its waiting period, in a state similar to sleep, which also interrupts our human time for hours. But time stands still in the tick's waiting period not just for hours but for years, and it starts again only when the signal "butyric acid" awakens the tick to renewed activity.

What have we gained by this knowledge? Something very significant. Time, which frames all events, seemed to us to be the only objectively consistent factor, compared to the variegated changes of its contents, but now we see that the subject controls the time of its environment. While we said before, "There can be no living subject without time," now we shall have to say, "Without a living subject, there can be no time."

We shall see in the next chapter that the same is true of space: Without a living subject, there can be neither space nor time. With this observation, biology has once and for all connected with Kant's philosophy, which biology will now utilize through the natural sciences by emphasizing the decisive role of the subject.

ENVIRONMENT SPACES

JUST AS A GOURMET picks only the raisins out of the cake, the tick only distinguishes butyric acid from among the things in its surroundings. We are not interested in what taste sensations the raisins produce in the gourmet but only in the fact that they become perception marks of his environment because they are of special biological significance for him; we also do not ask how the butyric acid tastes or smells to the tick, but rather, we only register the fact that butyric acid, as biologically significant, becomes a perception mark for the tick.

We content ourselves with the observation that perception cells must be present in the perception organ of the tick that send out their perception signs, just as we assume the same for the perception organs of the gourmet. The only difference is that the tick's perception signs transform the butyric acid stimulus into a perception mark of its environment, whereas the gourmet's perception signs in his environment transform the raisin stimulus into a perception mark.

The animal's environment, which we want to investigate now, is only a piece cut out of its surroundings, which we see stretching out on all sides around the animal—and these surroundings are nothing else but our own, human environment. The first task of research on such environments consists in seeking out the animal's perception signs and, with them, to construct the animal's environment. The perception sign of raisins does nothing for the tick, while the perception mark of butyric acid plays an exceptional role in its environment. In the gourmet's environment, on the other hand, the accent of significance falls not on butyric acid, but on the perception mark of raisins.

Every subject spins out, like the spider's threads, its relations to certain qualities of things and weaves them into a solid web, which carries its existence.

The relations of the subject to the objects of its surroundings, whatever the nature of these relations may be, play themselves out outside the subject, in the very place where we have to look for the perception marks. Perception signs are therefore always spatially bound, and, since they take place in a certain sequence, they are also temporally bound.

We comfort ourselves all too easily with the illusion that the relations of another kind of subject to the things of its environment play out in the same space and time as the relations that link us to the things of our human environment. This illusion is fed by the belief in the existence of one and only one world, in which all living beings are encased. From this arises the widely held conviction that there must be one and only one space and time for all living beings. Only recently have physicists raised doubts as to the existence of one universe with one space valid for all beings. That there can be no such space comes already of the fact that every human being lives in three spaces, which interpenetrate and complete but also partially contradict each other.

Effect Space

When we close our eyes and move our limbs, these movements are known exactly by us in their direction and their extension. Using our hand, we find our way in a space that one can designate the free space of our movements, or, in other words, our effect space [*Wirkraum*]. We measure these paths out in the shortest steps, which we will call directional steps, since the direction of each and every step is known exactly to us through the sensation of direction or *directional sign*. We distinguish six directions, in pairs of opposites: to the left and to the right, upward and downward, forward and backward.

Thorough experiments have shown that the smallest step we can execute, as measured by the index finger of the outstretched arm, is approximately two centimeters in length. As one can see, these steps constitute no precise measurement

of the space in which they are executed. Anyone can convince himself of this imprecision if he attempts, with closed eyes, to make his fingertips meet. He would see that this generally fails and that the fingertips miss each other by a distance of up to two centimeters.

It is of the utmost significance for us that we can retain these paths, once executed, very easily in our memory, which makes it possible to write in the dark. This skill is called "kinesthesia," which adds nothing new.

However, effect space is not just a space of movement constructed of a thousand crisscrossing directional steps. Rather, it possesses a system by which it is controlled, the well-known coordinate system, consisting of levels that are vertically arranged, one on top of the other. This serves as the basis of all spatial determinations.

It is of fundamental importance that everyone who is concerned with the problem of space persuade himself of this fact. Nothing is simpler. One need only close one's eyes and move one's hand, held perpendicular to the forehead, back and forth in order to establish with certainty where the boundary between right and left lies. This boundary practically coincides with the body's median plane. If one moves one's horizontally held hand up and down in front of one's face, one can easily establish where the boundary between up and down lies. This boundary is located at eye level in most people. Nonetheless, a great number of people place this boundary at the height of the upper lip. The boundary between front and back differs the most; it can be found by moving the forward-facing palm of the hand. A large number of people say that this plane is located at the opening of the ear, while others designate the zygomatic arch as the boundary plane, and others still place it in front of the tip of the nose. Every normal human being carries a coordinate system around with him that is made up of these three planes and is firmly connected to his head (Figure 4) and thereby confers a solid frame upon his effect space, in which these directional steps lurch and reel.

Into the shifting tangle of directional steps, which as elements of movement can give no solidity to the effect space, these resting planes project a firm scaffolding that guarantees the order of the effect space.

It was the great achievement of [Elie von] Cyon⁷ to attribute the three-dimensionality of our space to a sense-organ located in the inner ear, the so-called semicircular canals (Figure 5), the location of which corresponds approximately to

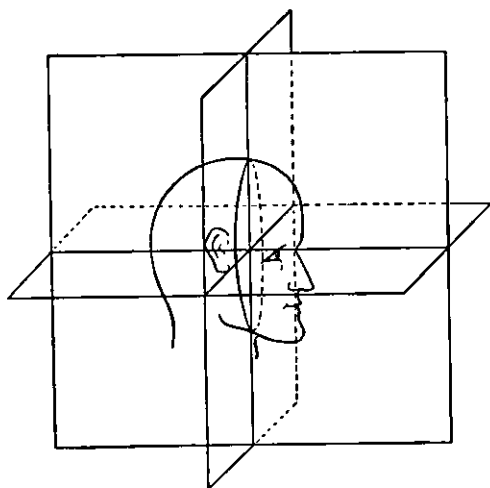


FIGURE 4. Coordinate system of a human being

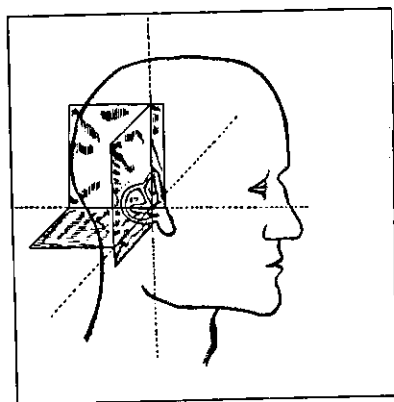


FIGURE 5. Semicircular canals of a human being

the three planes of the effect space. This connection has been demonstrated so clearly by numerous experiments that we can make the following assertion: All animals that have these three semicircular canals also have available a three-dimensional effect space.

Figure 6 shows the semicircular canals of a fish. It is evident that these must be of great importance for this animal. Their inner structure also supports this conclusion; it presents a system of tubes in which liquid, controlled by nerves, moves

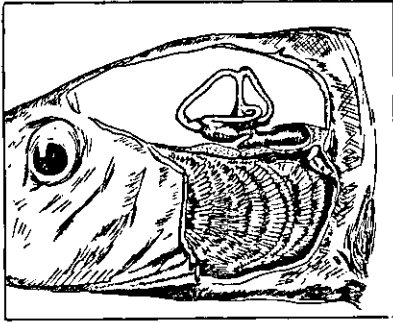


FIGURE 6. Semicircular canals of a fish

in the three spatial directions. The movement of liquid faithfully reflects the movements of the whole body. That indicates to us that, in addition to the task of transposing the three planes into the effect space, another meaning can be assigned to this organ. It

seems to be called to play the role of a compass as well—not a compass that only ever points north, but a compass for the “house door.” If all the movements of the entire body are analyzed and marked in the semicircular canals, then the animal must be back at its starting point when, in the course of swimming around, it has brought these nerve markings back to zero.

It is beyond all doubt that such a house-door compass is a necessary aid for all animals, whether the house door is a nesting or a spawning place. The establishment of the house door through optical features in visual space is in most cases not adequate, since it must be found even if it has changed its appearance.

The ability to find the house door in effect space can also be demonstrated in insects and mollusks, even though these animals have no semicircular ear canals. The following is a very convincing experiment (Figure 7): When most of the bees have flown out, a beehive is moved two meters. As it happens, the bees gather again at that place in the air where the exit hole—their house door—was previously located. After five minutes, the bees shift course and fly toward the hive.

These experiments have been carried further, with the result that bees whose feelers have been cut off fly immediately toward the relocated hive. This means that, as long as they are in possession of their feelers, they orient themselves

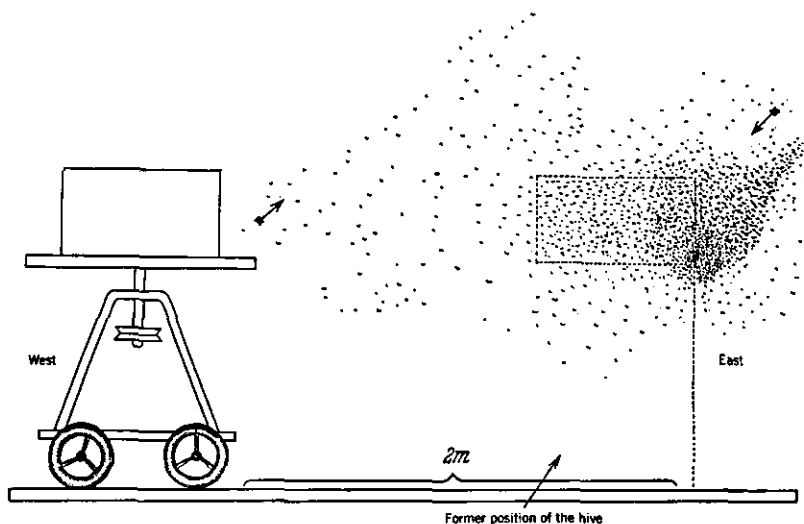


FIGURE 7. Effect space of the bee

foremost in effect space. Without them, they guide themselves by the optical impressions of visual space. The bees' feelers must therefore play in normal life the role of the house-door compass, which shows them the way home more surely than do visual impressions.

Even more conspicuous is the same homing behavior in the case of the common limpet (Figure 8). The limpet lives within the tidal zone on the cliff bottom. The largest individuals dig themselves a bed in the rock with their hard shells, in which they spend the low tide pressed close against the cliff. At high tide, they wander about and graze the cliff rock around themselves bare. When low tide arrives, they return to their beds, but they do not always choose the same path home. The limpet's eyes are so primitive that this snail could never find the house door with their aid alone. The presence of an olfactory perception mark is just as unlikely as that of a visual one. There remains only the supposition of a compass in effect space, of which, however, we can have no conception.

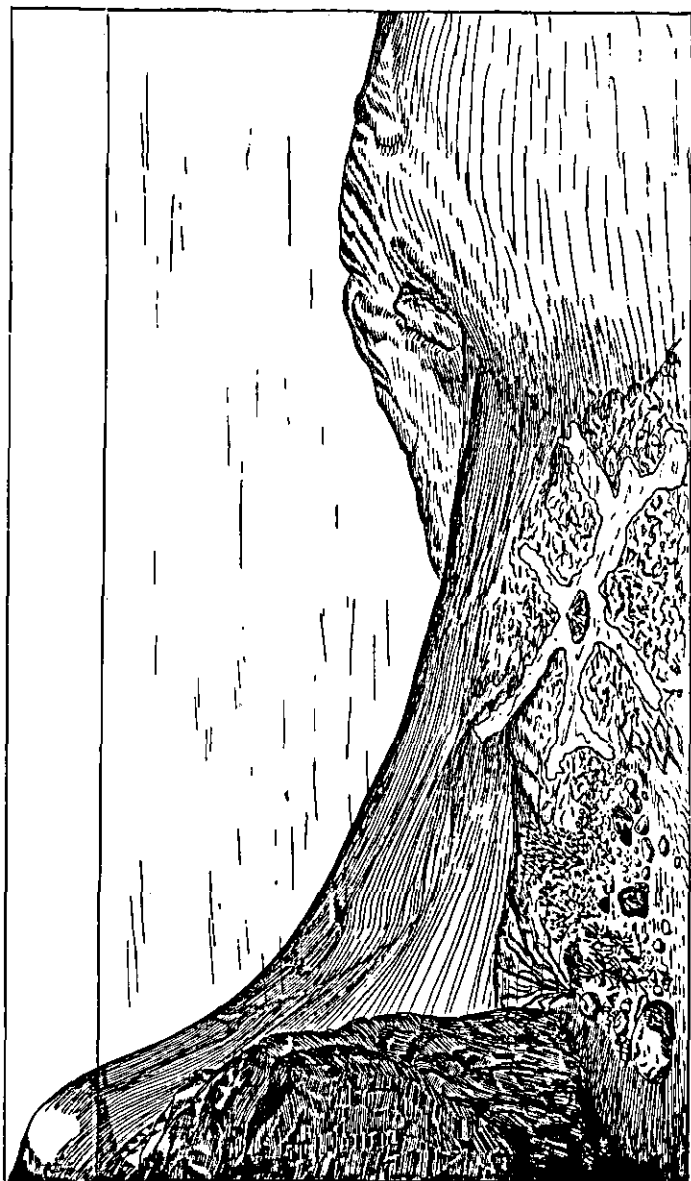


FIGURE 8. The limpet finds its way home

GOAL AND PLAN

SINCE WE HUMAN BEINGS are accustomed to dragging our existences wearily from one goal to another, we are convinced that animals live in the same way. That is a fundamental mistake that has led research to this point down the wrong path.

Nobody would ever attribute a goal to earthworms or sea urchins. But, in describing the life of the tick, we already spoke of how they lie in wait for their prey. With this expression, we smuggled our workaday human concerns, even without meaning to, into the life of the tick, which is led purely according to Nature's plan.

It should therefore be our first concern to extinguish the will-o'-the-wisp of the goal in our observation of environments. This can only happen inasmuch as we consider the vital expressions of animals from the point of view of the plan. Perhaps certain acts of the highest mammals will turn out to be goal-oriented actions which themselves are part of Nature's overall plan.

With all other mammals, actions directed at a goal are not at all evident. In order to demonstrate this statement, it will be necessary to give the reader a look at some environments that will leave no doubt that this is indeed the case. Figure 24 is the product of information I was kindly given on the perception of sound in moths. As indicated in the illustration, it makes no difference whether the sound to which the animals are attuned is the sound made by a bat or is produced by rubbing a glass stopper. The effect is the same. Moths that are easily visible because of their bright coloration fly away at the high-pitched sound, while those that have a protective coloration alight at the same sound. The same perception mark has the opposite effect in their case. This cannot be a case of making a distinction or setting a goal, since no moth has ever

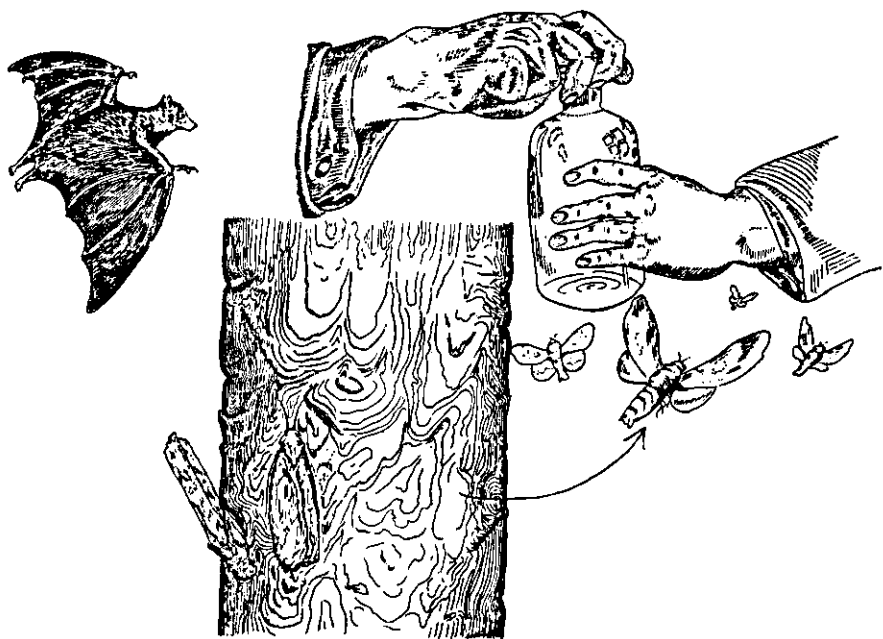


FIGURE 24. Effect of a high-pitched tone on moths

seen its own skin color. Our admiration for the planned character governing both is even greater when we discover that the artful microscopic structure of the moth's hearing organ exists solely for this single high-pitched tone emitted by the bat. These moths are totally deaf to all else.

The opposition between goal and plan is already evident in a wonderful observation by [J. Henri] Fabre.¹⁴ He placed a female emperor moth¹⁵ on a sheet of white paper, on which the moth performed motions with her abdomen. Then, he placed the female under a bell jar next to the paper. At night, whole hordes of males of this very rare species of Lepidoptera came flying through the window and crowded onto the paper. Fabre could not figure out what physical or chemical effect was emitted by the paper.

In this regard, experiments with grasshoppers and crick-

ets have been much more informative; Figure 25 depicts these experiments. In one room, in front of a microphone that serves as a reception device, there sits a lively fiddling individual. In another room, members of the opposite sex gather before a speaker, paying no attention to another individual who fiddles in vain because he is sitting under a bell jar, which his music does not penetrate. The mates cannot come together, since the optical image has no effect whatsoever.

Both experiments prove the same point: it is hardly a case of pursuing a goal. The peculiar-seeming behavior of the males [in the first case; females do not chirp] is readily explained if it is investigated from the point of view of its planlike quality. In both cases, a functional cycle is activated by a perception mark, but, because of the elimination of the normal object, the right effect mark is never produced; this would be necessary in order to cancel out the perception mark. Normally, another perception mark would have to step in as a substitute and trigger another functional cycle. The nature of this second perception mark requires closer examination. In any event, it is a necessary link in the chain of functional cycles that make sexual reproduction possible.

"That's all well and good," one might say. "There's no hope of finding goal-oriented action in insects. They are governed directly by Nature's plan, which, as we already saw in the case of the tick, establishes their perception marks immediately. But anybody who has ever been in a chicken run and seen how a mother hen rushes to the aid of her chicks cannot doubt the existence of truly goal-oriented actions." Some very nice experiments have provided complete certainty precisely in such cases.

Figure 26 explains the results of these experiments. When a chick is bound by one foot, it emits a loud peep, which immediately causes the mother hen to run toward the sound with ruffled feathers, even if the chick is not visible to her. As

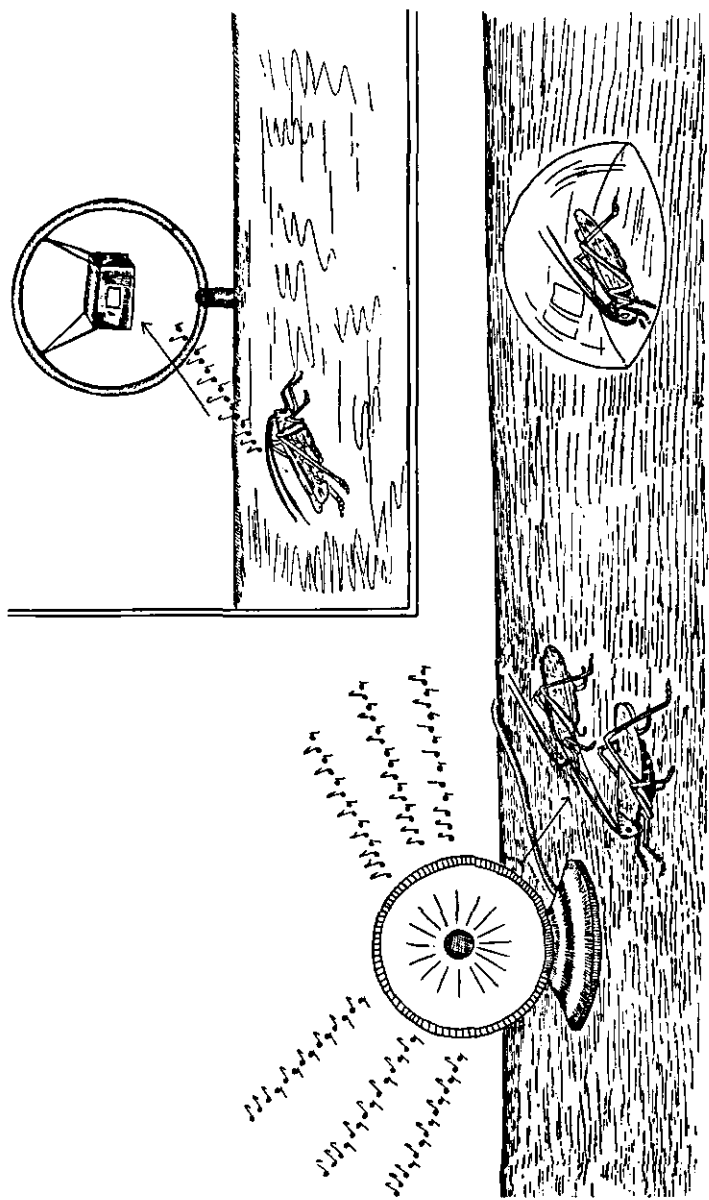


FIGURE 25. Grasshopper in front of the microphone

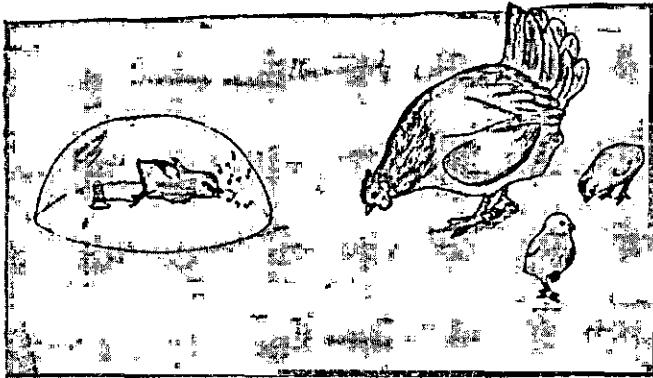
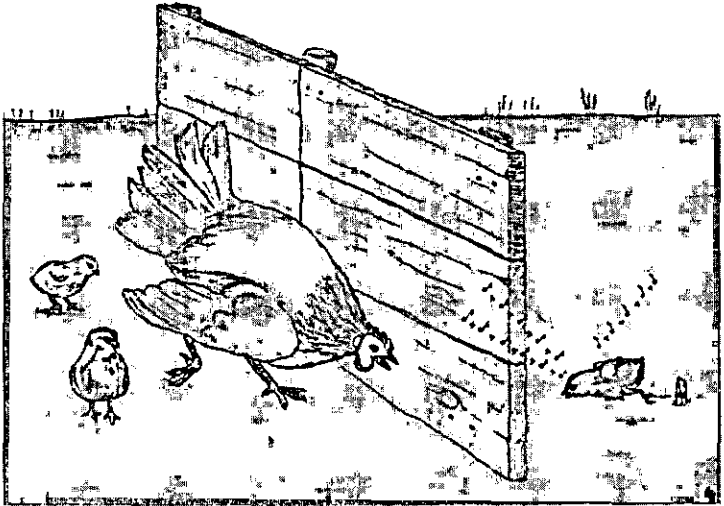


FIGURE 26. Mother hen and chicks

soon as the mother hen catches sight of the chick, she begins to peck furiously at an imaginary opponent.

However, if one places the fettered chick under a bell jar right before its mother's eyes, so that she can very well see it but not hear its peeping, she is not disturbed in the least by this

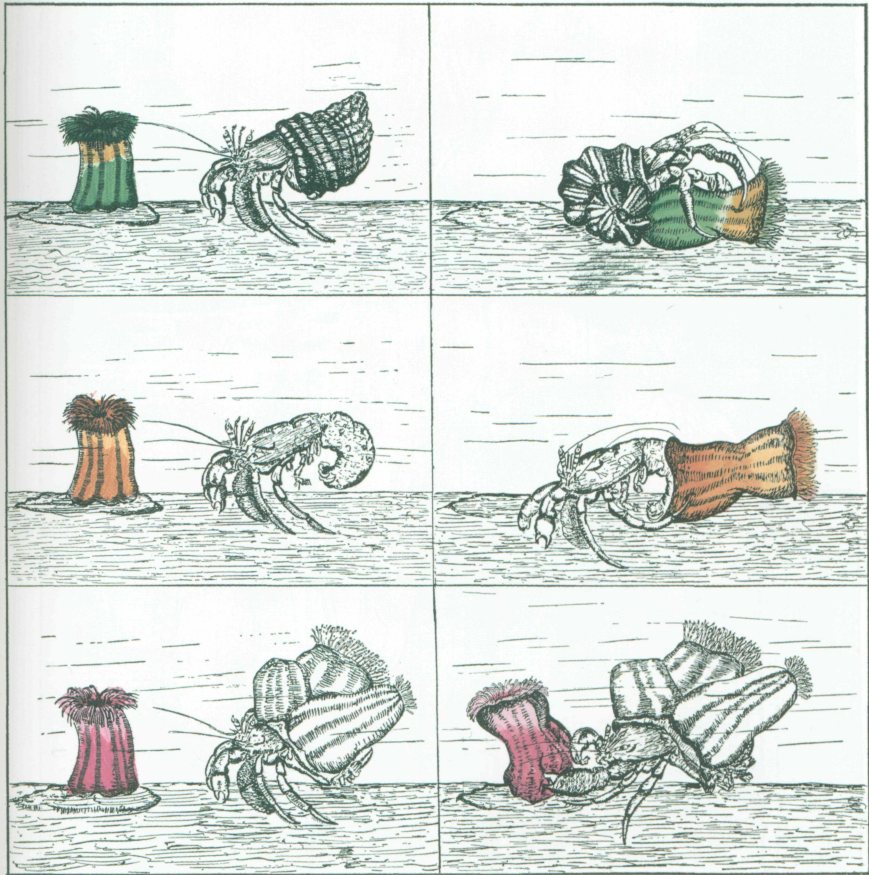


PLATE 1. Sea anemone and hermit crab

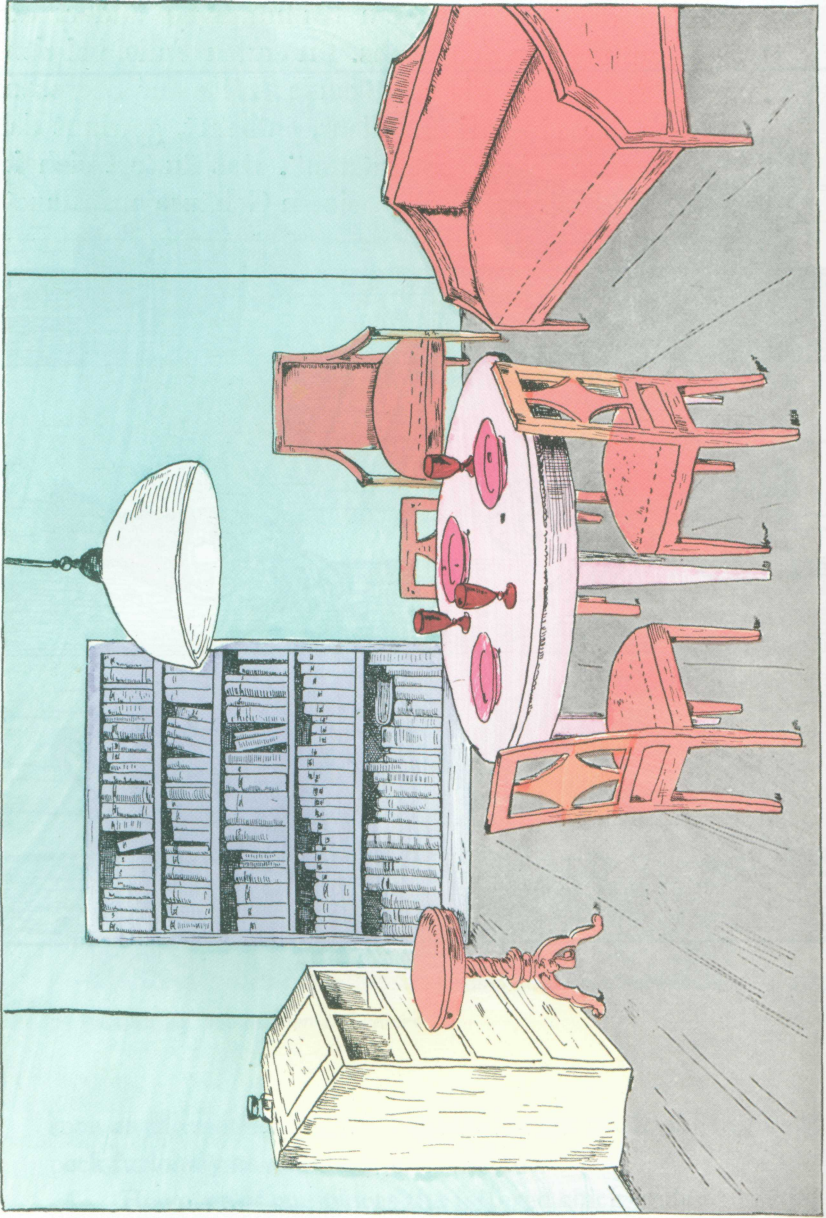


PLATE 2. The human being's room

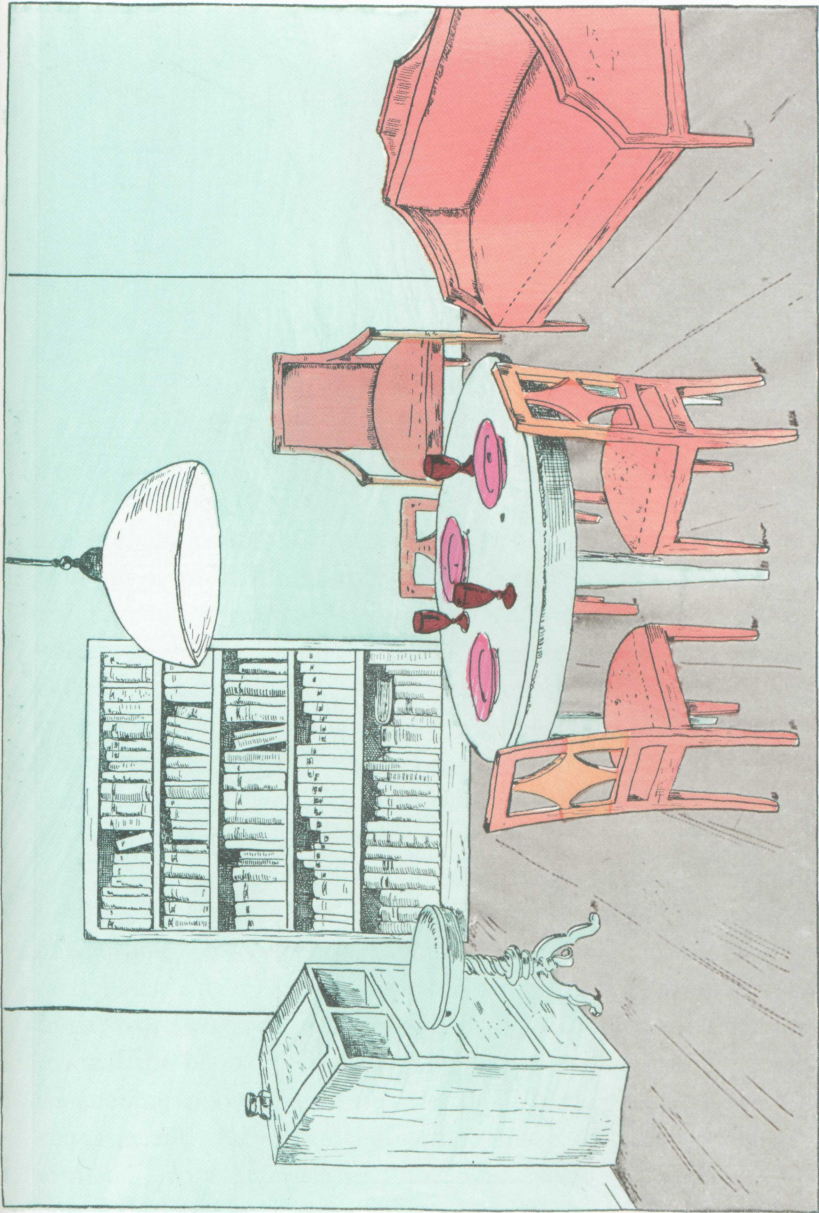


PLATE 3. The dog's room

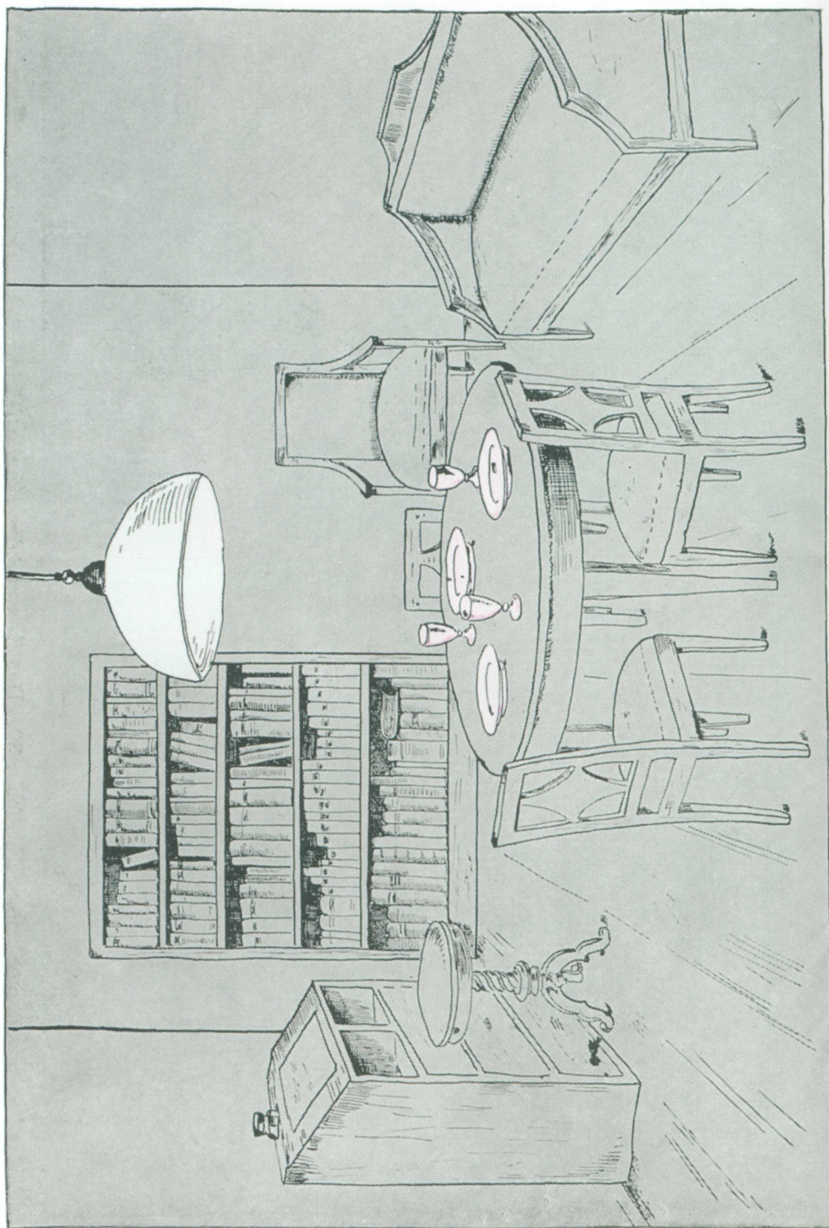


PLATE 4. The fly's room



FIGURE 27. Mother hen and black chick

sight. Even in this case, it is not a matter of a goal-oriented action but of an interrupted chain of functional cycles. Normally, the perception mark of peeping emanates indirectly from an enemy who is attacking the chick. This perception mark is cancelled out according to plan by the blows of the hen's beak, which chase off the enemy. The chick that flaps about but does not peep is not a perception mark that would trigger a particular activity. This would also be completely inappropriate, since the hen is hardly able to untie a cord.

The hen depicted in Figure 27 behaved in an even more peculiar and goal-less manner. She had incubated a set of eggs of another, white variety of chicken along with one egg of her own, black variety. She behaved in a completely senseless way toward the black chick, her own flesh and blood. She rushed toward the black chick's peeping, yet, if she became aware of its peeping among the white chicks, she hacked away at it. The acoustic and the optical perception mark of the same object aroused two contradictory functional cycles in her. The two perception marks of the chick had not coalesced into one unit in the hen's environment.