ARE ANIMALS CAPABLE OF CONCEPTS?

ABSTRACT. Often, the behavior of animals can be better explained and predicted, it seems, if we ascribe the capacity to have beliefs, intentions, and concepts to them. Whether we really can do so, however, is a debated issue. Particularly, Donald Davidson maintains that there is no basis in fact for ascribing propositional attitudes or concepts to animals. I will consider his and rival views, such as Colin Allen’s three-part approach, for determining whether animals possess concepts. To avoid pure theoretical debate, however, I will test these criteria using characteristic examples from ethology that depict a broad range of animal behavior. This will allow us to detect a series of gradations in animals’ capacities, in the course of which we can think over what would count for or against an attribution of concepts and propositional attitudes to them in each single case.

Self-conceit is our natural hereditary disease. Of all creatures man is the most wretched and fragile, and at once the most supercilious. . . . It is by this conceit that man arrogates to himself . . . divine properties, that he segregates himself from the mass of other creatures and raises himself above them . . .

(de Montaigne)

1. INTRODUCTION

From the perspective of the history of ideas, animals’ ability to ‘reason’ is of interest primarily for the light it sheds on the anthropological question of the place of man in nature. Today, however, the cognitive capacities of animals are examined in their own right. Their behavior can be better described, explained, and predicted, it seems, when animals are seen as ‘intentional systems’. In particular, this means ascribing to animals the capacity to have beliefs and intentions – and herewith, the capacity to have concepts. A desirable side effect of this line of inquiry may be that the insight it generates into the complex capacities of animals will tell us quite a bit about the cognitive development of man, too.

Nevertheless, there are strong intuitive reasons to believe that it would not only be difficult for animals to have concepts, but impossible. The
most pointed position, in this respect, stems from Donald Davidson. In the next section, I will consider his and rival views about ‘proper’ criteria for determining whether animals possess propositional attitudes and concepts. To avoid pure theoretical debate, however, I will test these criteria in the subsequent section using several examples from ethology. In the concluding section, I will propose an alternate means of structuring the field.

2. DAVIDSON’S ‘MÜNCHHAUSEN’-THEORY OF BELIEFS

Although Davidson (1985, p. 477; 1999, pp. 7–17) acknowledges that we often cannot do better than to use intentional vocabulary in interpreting animal behavior, he firmly maintains that there is no basis in fact for ascribing propositional attitudes or concepts to animals. For, among the numerous presumed intentions and beliefs attributed almost inflationarily to other creatures, only few meet the criteria for a genuine command of concepts and having of beliefs.

Of the various requirements that must be fulfilled, according to Davidson, by genuine beliefs and their potential bearers, I will discuss two in more detail: (i) the thesis that each attribution of a propositional attitude produces an intensional context; and (ii) the thesis that only systems that have the concept of belief can have beliefs and other propositional attitudes.

An essential characteristic of belief attributions is their opacity or intensionality. That is to say, when we say that somebody believes something, the way we say it is key: Christian might doubt, for example, that a philosophy professor at the university of Karlsruhe has edited a book on ‘Die Vernunft der Tiere’, while at the same time believing that Hans-Peter Schütt (who is in fact a philosophy professor at the university of Karlsruhe) has managed to publish a book with this title. Thus, for the validity of belief ascriptions it is always decisive which words we choose to ascribe a propositional attitude to someone.

Even more important for Davidson’s position are his strong intuitions about whether or not a creature is capable of having any beliefs at all if she lacks the concept of belief altogether. In his article ‘Thought and Talk’ he succinctly states: “It seems to me it cannot” (1975; 1984, p. 170). Although he attempted to elucidate his position in more detail in several subsequent articles, he did not present arguments for it in a strict sense.

Davidson claims that a creature, or let us say more generally: some system, can have a genuine belief only if it also has a concept of belief.
But what does it mean to have a concept of something? Let us look at one of Davidson’s examples: ²

To have the concept of a cat, you must have the concept of an animal, or at least of a continuing physical object, [...], something that can move freely in its environment, something that has sensations. There is no fixed list of things you have to know about, or associate with, being a cat; but unless you have a lot of beliefs about what a cat is, you don’t have the concept of a cat. (1999, p. 8)

Transferred to the concept of belief, this amounts to the following: To have the concept of belief is, e.g., to have the concept of a propositional attitude, to understand that what one believes might nevertheless be false, and this means grasping the difference between truth and falsehood, i.e., knowing the difference between true and false beliefs. Thus, without having quite a lot of beliefs about what a belief really is, one cannot have the concept of belief, and without that one cannot have any beliefs at all. And from this it follows that without having the concept of belief one cannot have any other concept at all. For, without having quite a lot of beliefs, one cannot have concepts. So we get: Without having the concept of belief, one has neither beliefs nor concepts.

Davidson himself refers to this – for him so characteristic – problematic as the holism of the mental. Less respectfully we might call it Davidson’s ‘Münchhausen-theory of beliefs and concepts’: As the famous Baron Münchhausen pulled himself out of the swamp by his own forelock, here all concepts and beliefs get drawn out of the realm of the pre-mental by a second-order concept, namely the concept of belief.

However, Davidson does not want his theory to be understood to mean that a mental state only constitutes a genuine belief in those cases when at the moment of having the belief we are aware of its nature as such. Rather, it would suffice for a system to be able in principle to have the concept of belief, that is to say, it need only be potentially able to realize the nature of its attitudes (cf. 1985, p. 479). Otherwise, even we would forfeit many of our putative beliefs.

Yet, even this more moderate position has far-reaching consequences. It seems clear that neither animals, nor infants, nor demented adults would belong to the set of systems that can have beliefs and concepts in Davidson’s strict sense. For of which animal or infant can it sincerely be claimed that it has the concept of a belief as, e.g., a propositional attitude that might just as well be false?

Davidson not only renders explicit what is to be seen as a necessary condition for the having, and herewith, for the justified ascription of beliefs and concepts to some creature, he also states what is to be considered
insufficient for the having of a concept, namely the ability to discriminate certain things from others.

A creature does not have the concept of a cat merely because it can discriminate cats from other things in its environment. For all I know, mice are very good at telling cats apart from trees, lions, and snakes. But being able to discriminate cats is not the same as having the concept of a cat. (1999, p. 8)

Here, Davidson argues particularly against behavioristic, but also against some post-behavioristic tendencies to interpret an animal’s discriminatory capacities as the mastering of a concept. The experiments of Herrnstein and his research group, published under the title ‘Natural Concepts in Pigeons’ (1976), are just one example of research in this area. According to Herrnstein, pigeons are able to peck on distinct feeder keys depending on whether a picture shown to them belongs to a certain category, e.g., trees, or not. I agree with Davidson as well as with other critics, such as Allen and Hauser (cf. 1996, p. 50f.), that experiments such as these do not show that the participating animals master any concepts at all.

As things now stand, I do not think that the crucial question is whether or not Davidson has posited a plausible category of systems, namely those that can have beliefs and concepts in a strong sense. For no one would dispute the existence of such systems: we, for example, are such systems. Rather, the decisive question is whether other plausible categories of the Intentional exist which can be located between the strong notion of having beliefs and concepts in Davidson’s sense, on the one hand, and the weak notion of being merely able to make some discriminations, on the other.

Marcia Cavell who makes no secret of her affinity to Davidson, seems to think of the space between these two notions as an empty set:

A creature cannot be said to believe in what we might call a ‘hard’ sense of that word, one that distinguishes reflexive and instinctive behavior from intentional behavior, unless it has the concept of belief as something which can be true or false. […] It is a grasp of these concepts that is needed to distinguish discriminatory reaction […] from Intentionality. (1993, p. 38)

Here, Cavell ascribes intentional behavior to only those systems that have beliefs and concepts in Davidson’s strong sense; all other behavior, she claims, is based on a simple discriminatory capacity shared in sufficiently similar form by infants, sunflowers and thermostats. Davidson himself is satisfied to merely diagnose our inability to conceptually grasp the space between genuine kinds of intentionality and mere discriminatory behavior.

We have many vocabularies for describing nature when we regard it as mindless, and we have a mentalistic vocabulary for describing thought and intentional action; what we lack is a way of describing what is in between. This is particularly evident when we speak of
the ‘intention’ and ‘desires’ of simple animals, we have no better way to explain what they do. (1999, p. 11)

What is mentioned by Davidson in passing, namely that we often have nothing better than so-called intentional explanations for animals’ behavior, is for some others a criterion for attributing genuine beliefs and concepts to a creature. Stephen Stich has sketched this position, however, without himself holding it:

[I]f animals have beliefs then the best psychological explanation of animal behavior will be provided by a theory which, for the most part, is an elaboration and refinement of our informal belief-desire theory. And conversely, if our intuitive theory is a tolerable first approximation to a correct theory, then animals do have beliefs. (1979, p. 17)

However, Davidson could reject such an approach as question begging: For if there are good reasons to doubt that a system has genuine intentional states at all, then explanations of its behavior that make use of intentional states cannot be best explanations. At best, they could be heuristically acceptable quasi-explanations. Conversely, it could be responded that it makes good sense to grant the existence of those entities and events to which the theoretical vocabulary of successful theories refers.

A completely different proposal to survey our ‘terra incognita’ comes from Colin Allen (1999, p. 37). According to Allen, it is justified to attribute the having of the concept \( x \) to a system \( s \) if \( s \) can (i) systematically discriminate between \( x \)s and non-\( x \)s, (ii) recognize its own discrimination errors, and (iii) hereby learn to better discriminate between \( x \)s and non-\( x \)s.

Before we get entangled though, in even deeper theoretical considerations, and embark on a discussion, for example, of whether Allen’s criteria in fact suffice for the attribution of concepts to a system, I propose changing the level of investigation for a while, moving first of all to various characteristic examples from ethology. I have chosen examples that depict a broad range of animal behavior. This will allow us to detect a series of gradations in their capacities, in the course of which we can think over what would count for or against an attribution of concepts and propositional attitudes to an animal in each single case.

3. WASPS, BIRDS AND MONKEYS

3.1. Dim-Witted Wasps

Even among philosophers, sphex has become famous through a number of articles by Daniel Dennett. After being fertilized, female wasps dig a burrow, then look for a cricket, paralyze it and bring it to the entrance of
their burrow. Before dragging the cricket into the hole, where it will be serve as food for their grubs, they inspect the burrow for parasites. If none are to be found, spheges close the hole and leave their descendents to them-selves. The wasp’s behavior is perfectly adapted to its living conditions. It is very successful, such that a sphex need not lay more than ten eggs. However, under experimental conditions this cycle of behavior can easily be disturbed: If, while the sphex inspects the burrow, the cricket is moved just a few inches, the sphex will not drag it into the hole as usual, but bring it back to the entrance and then commence another inspection. And it will do this again and again and again.

Although in many situations, wasps show remarkable capacities for memory, orientation, and discrimination – for example, they recognize crickets and find their way back to the burrow even from great distances – spheges appear dim-witted within the unnatural experimental setting. Neither do they mind nor do they remember – there is no learning. Spheges cannot adapt adequately to – at least from our point of view – only marginally changed conditions, since they have no influence on the mechanisms that govern their behavior.

Spheges’ behavior shows a denseness that precludes any ascriptions of propositional attitudes. For, if they had beliefs about the burrow’s state and wished to deposit the cricket as nourishment for their descendents, then it would be bizarre for them to inspect the burrow again and again (if such a behavior were evinced by creatures whom we usually interpret as intentional agents, we would characterize it as compulsive or obsessive). The wasps’ behavior can be better explained by the positing of a rigid mechanism that is sensitive only to specific triggers than by intentional explanations, for the former explains all that is to be explained.4

3.2. Nauseous Birds

The next example I want to consider is from Fred Dretske (1999). He describes a foraging bird’s simple avoidance behavior and argues that this behavior justifies ascribing intentional attitudes to the bird. The story is as follows:

A foraging bird tries to devour a monarch, a butterfly that is indigestible as its caterpillars live on a toxic form of milkweed. Its consumption causes birds to vomit. One trial suffices for the bird to avoid butterflies that look like the monarch. A day later the bird encounters a viceroy, a butterfly that mimics the appearance of the monarch although itself not poisonous. The bird sees the viceroy and flies away.
Dretske asks why the foraging bird turned down a perfectly tasty meal. Why didn’t the bird eat the viceroy? In our answer, Dretske reminds us, we should choose our words carefully. His proposal runs as follows:

If the bug it saw happened to be a poisonous Monarch, we could have said that it recognized the butterfly as one of those nasty tasting bugs and avoided it because it didn’t want to get sick again. But what it saw was not a nasty tasting bug. No recognition took place. There was no knowledge. We need a different word. What is it we (philosophers) call some perceptual state that would be recognition or knowledge if only it were true? Belief! So the bird believes the bug it sees tastes bad. This is what it thinks. (1999, pp. 19–31)

However, should we really say the bird does not want to become sick, and believes that the butterfly dancing before its eyes is a specimen of that nasty species causing it to vomit? Are we really ready to concede that the bird knows that it sees an indigestible meal if it encounters an actual monarch?

No doubt, compared to the wasp, the foraging bird shows more elaborated capacities of discrimination and learning. However, its classification of some potential prey as indigestible is extremely rigid, it is hardly modifiable afterwards. From an evolutionary point of view this makes good sense. Both rigidity in avoidance behavior and over-generalizations are valuable aids to survival. In case of doubt, it is simply better for a bird to occasionally do without a tasty meal than to poison itself again. Only in the case of a scarcity in its food supply could the bird’s strategy harbor unfavorable consequences. As is to be expected, mechanisms of avoidance of indigestible food like those of the bird’s are widespread in the animal kingdom. As far as we know, however, neural processes involved in avoidance reactions proceed subcortically, that is to say, they occur within brain regions that normally are not associated with thought processes. Even snails can form and maintain food aversions after one single trial (cf. Reichert 1990, p. 364).

Based on our knowledge of the mechanisms that govern behavior in the case of food aversions, and contrary to Dretske, I take it to be inappropriate to attribute any propositional attitudes to the bird to explain its avoidance behavior. In the case of the wasp as in that of the bird, non-intentional explanations, e.g., functional explanations, seem to better account for behavior.

The claim that we should not explain a bird’s food avoidance behavior intentionally does not imply, however, that there is no bird behavior that could justify an ‘intentional stance’ towards them. Indeed, even human beings display behaviors from time to time that we would be better not explaining intentionally.
3.3. *Piping Plovers’ Protection of Their Young*

In extensive field studies Carolyn Ristau has investigated the behavior of piping plovers in the face of various intruders. Most eye-catching is their so-called ‘broken wing display’ by which they feign a lame wing. In doing so, piping plovers hop into an intruder’s field of vision and attract its attention, only to move farther and farther away from their young. Hereby they monitor the movements of the predator all the while. Depending on the intruder’s reactions, piping plovers modify their own behavior. If the predator follows the bird far enough away from the nest, or if it gets too close to the feigning bird, the piping plovers will fly away. If, on the other hand, the intruders do not follow, they move back into their field of vision to attract their attention once more.

Equally remarkable as the ‘broken wing display’ is the variety of the piping plovers’ behavior vis à vis various intruders. Unlike cats, cows do not care about eggs or nestlings. They sometimes stamp the birds’ breed inadvertently, and are thus a danger to its offspring. If cows approach, then, the clever piping plover does not display a broken wing, which would be of no interest to a cow. Instead, it remains at the nest, and if the cow approaches too close to the breed, the plover flutters demonstratively in the cow’s face. As a rule, cows turn away from the nest, such that the risk of the cow’s inadvertent slip is averted.

Thus, depending on the intruder and specific circumstantial variables, piping plovers are able to modify their own behavior such that it always seems to protect their offspring optimally. To the same extent that the flexibility of the piping plovers’ behavior complicates simple non-intentional explanations, its obvious goal-directedness suggests an intentional stance towards the bird. According to Ristau’s own account, she achieved several of her own impressive results only by treating piping plovers as *intentional systems*.

Yet is it judicious to ascribe to the piping plover – merely for the heuristic value of an intentionalist approach – concepts and beliefs, for example concerning different types of intruders? Ristau herself is cautious (cf. 1996, p. 88). Even if piping plovers have no *concept* of belief, in light of the complexity of their behavior, it seems plausible to posit the existence in them of internal states which correspond to simple beliefs and volitions in us. Further research into piping plovers’ potential to detect their own discrimination errors and to discriminate better afterwards would be worthwhile. It might result in interesting findings.
3.4. Vervet Monkeys

Seyfarth and Cheney’s field studies on vervet monkeys in the area of Amboseli National Park in Kenya are of significance both for ethology and philosophy. Among other things, vervet monkeys evince three remarkable capabilities (see Seyfarth et al. 1980).

To begin with, they are able to warn each other of the approach of various predators by distinct alarm calls. If leopards (or other mammalian carnivora) approach, they give the so-called leopard-alarm. Upon hearing it, the other vervets flee to nearby trees where they are safe from leopards. If, on the other hand, vervets perceive the so-called eagle-alarm, they look up to the sky and escape, if necessary, into leafy bushes, for eagles can prey on monkeys on both the ground and in the upper regions of trees. Two further warnings were classified by Cheney and Seyfarth as snake-alarm and baboon-alarm calls, respectively.

Second, growing life experience improves accuracy of vervet monkeys’ alarm calls, significantly. While young vervets respond with an eagle-alarm call also to harmless birds and even to falling leaves, they gradually learn to hit the mark. Apparently, apt alarm calls are reinforced by adult members of the group (see Allen and Bekoff 1997, p. 121).

Eventually, Cheney and Seyfarth report situations in which vervets seem to deliberately give false alarm calls to gain an advantage for themselves or their group. Thus, during a quarrel between two groups of vervet monkeys about the boundary of their territories, an individual of the losing group climbed up a near tree and gave ‘leopard alarm’, although no leopards have been around. The alarm call caused the fighting vervets to turn tail and to swarm up the trees. By this means the quarrel was brought to an end, the original territorial bounds were re-established.

Since it was also observed that vervets refrain from reacting to individuals that have already given several false alarm calls, there is good reason to believe that they compare conspecifics’ utterances with reality to prove aptness. Thus, vervet monkeys seem to be capable to distinguish between true and false alarm calls.

As the examples of the young that improve on giving eagle-alarm calls in the right situations show, vervets meet Allen’s criteria for having concepts. They are able to recognize their own discrimination errors, and they can do better in time. Likewise, it seems to be clear that we can hardly refrain from using an intentional vocabulary, if we want to explain vervets’ deception behavior adequately. In contrast, it seems to be questionable whether there exists a definite description under which a propositional attitude could be ascribed to vervet monkeys. Just so, it is questionable whether they have the concept of belief in Davidson’s strong sense, al-
though it looks as if they have a rudimentary form of it through their capacity to recognize wrong alarm calls of conspecifics.

3.5. Kanzi

Conventional studies about animals’ use of symbols are still contaminated by behavioristic conditioning techniques. Since correct responses are rewarded – depending on the animal – with fishes, bananas or earthworms, respectively, such experiments tell us little about animals’ communicative intentions, for their primary interest is to receive the food.

Learning from this, Sue Savage-Rumbaugh sought a different design for her experiments with bonobos. She tried to imitate the conditions under which a child normally acquires a parent’s language: namely, in communicative situations in which the child actively participates – without rewards with goodies.

Accordingly, young bonobos were brought together with caretakers who regularly talked to them about daily events, such as trips to the woods, tickling and chasing games, or visits of other primates. As they spoke, the caretakers always pointed to relevant keyboard symbols. The bonobos were not required to use the keyboard, in order to receive food or anything else. Instead, the caretakers talked to them about what they had just done together, and about what they were going to do next. After a while, the bonobos themselves began to use some of the symbols. As with children, the individual bonobos’ first ‘words’ were not all alike, though there was some overlap. A phase of purely passive use, in which they merely named the situations in which they currently found themselves, was followed by a phase of more active use in which they used the keyboard to communicate their own wishes.

Of particular interest is the linguistic behavior of Kanzi, Savage-Rumbaugh’s model pupil. Kanzi developed new combinations of signs for which he had no past experience. For example, he once uttered ‘car trailer’ to indicate that he wished to be taken by the car to the trailer. He reinforced his use of the symbol with a gesture towards the trailer. As he was asked in English whether he wanted to be driven by car to the trailer, he reacted with excited vocalizations. Savage-Rumbaugh comments as follows:

Had Kanzi said ‘car’ alone, this single symbol utterance would have been interpreted as a comment about being in the car and would have simply been acknowledged. Had he said ‘trailer’ alone, the caretaker would probably have simply gotten out of the car and walked with Kanzi to the trailer, since it was a very short distance to drive. However, by saying ‘car trailer’ Kanzi produced a novel meaning and brought about a set of events that otherwise would not have been likely to occur. (1996, p. 280)
Kanzi’s creative use of learned symbols in new combinations demonstrates that he has cognitive access to his own wishes and can represent them internally. In addition, Kanzi is capable of aptly articulating his desires. However, does this mean that he has the concept of a belief or a desire? Do the attributions of intentional attitudes to him based on his use of symbols produce an ‘intensional context’? As I see it, at least the last question should be affirmed. For in further examinations, Kanzi’s caretakers might try to repeat his putative wishes in differing, but extensionally equal words. Presumably, Kanzi’s reactions would allow to discern with which of the various descriptions he can be said to want something or not.

4. CONCLUDING EVALUATION

I close with a concluding judgement.

Toward neither the wasp nor the butterfly-avoiding bird is an intentional stance warranted; neither criterion presented above for justifying attribution of propositional attitudes to a system are met. No doubt, both animals demonstrate capacities of discrimination, but they show no plasticity in their further behavior.

By contrast, intentional explanations are helpful in understanding the piping plover’s protective behavior. Even if it does not meet Davidson’s criterion for the having of concepts, it might meet Allen’s criterion. This remains to be proven, however, by further investigations. I characterize the propositional attitudes that can be attributed to piping plovers as intension-less propositional attitudes. One should speak of such attitudes in cases where the ‘inference to the best explanation’ suggests the supposition of intentional attitudes, but where it is nonetheless un-plausible to assume that an attribution of such attitudes would produce an intensional context. In the case of piping plovers, for example, there is no description, with which they can be said to have beliefs. If piping plovers believe, they do not so under a description.

The vervets’ behavior, however, is hardly explicable without assuming an intentional stance. They clearly meet Allen’s criterion for a justified ascription of concepts. Admittedly, their elusive behavior does not imply that they have a ‘theory of mind’. It is, however an impressive indication of first order intentions. They even seem to fulfil some of Davidson’s demands for the having of beliefs. For vervet monkeys evidently can distinguish between true and false alarm calls. This means, according to Allen’s criterion, that they might even have the concept of a true or a false report. But, here again, it is unclear with which description any belief or want could be ascribed to a vervet monkey. According to Chater and Heyes
(1994), it has to remain empirically unresolved whether or not one of their alarm calls means: ‘beware of leopards’, ‘beware of mammalian carnivores’, or ‘beware of 98 leopards that find vervet monkeys tasty’. Here, as before, I suggest that we at the very least can attribute intensionless propositional attitudes to vervet monkeys, or perhaps propositional attitudes the intensionality of which is currently undefinable. Since we have no communicative contact with them, there seems to be no way of learning more about their intentional attitudes.

In contrast to all animals discussed above, Kanzi participates in communication: He not only has desires and beliefs, he also communicates them. In addition, he is capable of inventing new symbolizations that are apt for expressing his more complex desires. He hereby shows a remarkable degree of reflection. Interestingly, Kanzi’s reactions to his caretaker’s interpretations show great similarities to our own linguistic behavior and capacities in foreign language communities. Our passive vocabulary is also much higher than our active word-power. Kanzi’s passive vocabulary is nevertheless sufficient to reveal something about the intensions of his intentional states. Even if Kanzi’s language is still very simple, he still fulfills one of Davidson’s conditions for ‘true believers’. I would be very surprised if Kanzi had not also developed some understanding of true and false communications. I thus consider Kanzi to be an empirical case that, admittedly, does not argue against Davidson’s criteria, but does argue against his interpretation according to which only humans are capable of meeting them.

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NOTES

1 See, e.g., Hans-Peter Schütt’s Die Vernunft der Tiere (1990).
2 Cf. also Georges Rey’s contribution about ‘Concepts’ (1994, pp. 185–193).
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3 Cf. also Gordon Brittan (1999, p. 60f.).
4 By the way, there is no dispute about the inadequacy of intentional explanations in the case of wasps. Dennett, too, mentions it merely to show that situations exist in which intentional explanations are ruled out by mechanistic ones, even in such cases in which we might prefer to take an intentional stance towards the system under consideration (see 1978, p. 65).
5 Even against individuals that have behaved differently towards their nest before, piping plovers show differing reactions (see Allen and Bekoff 1997, p. 119f.).
6 The bird’s behavior might possibly be explained by reference to schemata formation in a connectionist net: If an intruder approaches the bird’s nest, a ‘nest-protection’-schema gets activated, yet only if eggs or young birds are in the nest. Depending on the intruder’s characteristics, specific motor-subschemata are activated that trigger apt reactions, e.g., ‘broken wing display’ in the case of cats, a sudden fluttering in the intruder’s face in the case of cows, etc.

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