What's inside a thinking animal?

For a philosopher to speculate about animal cognition is implicitly to engage in theoretical psychology or theoretical neurology at a very high level of abstraction. As with all sciences, research in psychology and neurology need to be guided by speculative hypotheses, in these particular cases, by hypotheses about what kinds of functions, hence structures, it would be sensible to look for. We philosophers may be in a position to help, but we can't expect armchair argument to go very far. In the end, all the questions are rock-bottom empirical.

My own speculation is that the major break between the way humans and other animals think has less to do with the nature of the inference processes, or lack thereof, involved than with the methods used to form adequate concepts. I am not nearly as impressed with the differences in practical reasoning abilities between we humans and other animals as with differences in the kinds of information we are able to grasp and to feed into those reasoning processes. Most everyday practical human activity seems to be guided, moment by moment, in much the way higher animal activity is. Goals are envisioned — represented — and moved toward by means first of abstractly knowing how, understanding how the reaching of first this and then that prior goal will lead to a further goal, then by filling in, step by step, making the abstract concrete by following sensory affordances — roughly, Gibsonian affordances — from here to there to there, step by step. Mostly this does not involve much reasoning out; both we and the animals have reached most of these everyday kinds of abstract goals before, though in the human case often as a result of instruction rather than mere exploration or trial and error learning. Usually there is little or no reasoning involved in driving a car or in hoeing

the garden or in getting dinner. Clearly humans do a lot more thinking ahead than do other animals, they project and follow through much more complicated chains of embedded goals, they sometimes attempt to do quite novel things, and sometimes engage in very sophisticated trial and error reasoning on the way. But I suspect that these patterns remove us from other animals only as a matter of (very considerable) degree. The key difference in kind between us — a difference that actively supports the possibility of sophisticated action planning when it occurs in humans — is our capacity to develop what I will call here "theoretical unicepts." Animals, I think, never get beyond "practical unicepts."

Let us suppose that you have both a dog named Rover and also a spouse or housemate named Bret. You and Rover share a quite remarkable, highly complicated ability with regard to Bret. You are both able to recognize Bret from the front, from the back. from the right side, from the left side, indeed, from almost any angle, also from 20 meters away or from 20 centimeters away or from any of many other distances, also under many different lighting conditions and, indeed, whether Bret is sitting or standing or lying down, or partly occluded by a chair back or the table, whether Bret is moving or still, by Bret's voice from any of many distances or as it passes through a variety of media such as through lightweight walls, under water, over the phone and so forth. Rover will surely know Bret by the smell and probably by the way Bret touches him, perhaps by when Bret returns home (Rover knows it's now Bret at the door), and you may recognize information arriving about Bret by Bret's signature, by recognizing Bret's style of humor or by the sound of the instrument Bret plays coming from the next room. In short, you and Rover each have a complex, quite amazing — still very little

understood — skill, *namely*, you can bring to one focus many bits of natural information in the form of a hugely diverse set of proximal stimulations impinging on your sensory surfaces, but all of which carry natural information about just one thing, Bret, allowing you to accumulate knowledge of that one thing over time, possibly using it in mediate inferences, certainly putting it to use during later encounters with Bret.

This capacity to identify information arriving at your sensory surfaces in indefinitely may kinds of proximal packages as information about the same distal object is, of course, the capacity to "reidentify" that object. What the psychologists call "color constancy," "shape constancy," "sound source recognition" and so forth are — similarly — capacities to reidentify various kinds of *properties* through different proximal stimulations. We also have capacities to reidentify many *real kinds* in a great diversity of ways. Think how many different kinds of proximal stimulations may manifest either to you or to Rover the current presence of a cat. Not only can cat properties each manifest themselves to the senses in multiple ways, there are many different small sets of properties unique to cats (at least in the circles in which you and Rover normally walk) by any of which they can be identified. There are very many equally good ways to recognize a cat as such. These amazing abilities that you and Rover have to reidentify objects, properties, kinds and so forth, like other abilities that you have, are of course fallible. That you have them does not imply that you never misidentify, any more than that you have the ability to walk implies that you never trip.

I'm proposing to call these abilities "unicepts"... "uni" for one, of course, and "cept" from Latin "capera," to *take* or to *hold*. A unicept is a taking or holding as one — it is a capacity which takes in many proximal stimulations and holds them as one distal

object, property or kind.

[As a working model, we can think of a unicept, the capacity to reidentify something, as the capacity to employ the same mental sign again when the same distal object is encountered. Thus we couple unicepts with something like "mental signs," naming them according to these signs. Having a unicept involves the capacity to couple new information with information gathered in the past under the same mental sign so as to bear on further thought and action.]

Clearly, unicepts are of central importance for perception and cognition of any sophistication at all, and it seems clear that both we and the higher animals have them. There are animal psychologist's who believe that all animal learning is merely associative, but surely the association is not merely among proximal stimuli. Animals too must have unicepts of distal things. My suggestion will be that only humans have theoretical unicepts, however. Other animals have only practical unicepts. What then is the difference between a practical and a theoretical unicept?

Notice first that unicepts are not dispositions but rather abilities. To be unicepts, there is something they should *succeed* in doing. They should succeed in unifying or making one in the mind what was originally one in the distal environment, but manifestations of which had been scattered through diverse media before arriving at the cognizer's sensory surfaces. Consider then the problem how unicepts might be acquired through evolution of the species or through individual learning. How might natural selection or individual experience have tuned the cognitive systems to put only proximal stimulations that have been scattered from the same distal object or kind into the same perceptual/cognitive basket? What epistemological criterion might be used by

natural selection or by the cognitive systems to distinguish genuine, adequate unicepts — ones that are for the most part succeeding in their reidentifying tasks — from those that are failing?

One way that this might be done is through the use of candidate unicepts in the direction of practical activity. If it is possible to learn how to use or react to the postulated same-distal-object or same-distal-kind so as to obtain uniform useful results, this is evidence that one is reidentifying correctly. Rover needs to handle cats one way, rabbits another. (Cats may run up trees or they may turn and scratch you viciously; rabbits may dive into the brush.) That he has learned to identify and distinguish between rabbits and cats is evidenced by his having learned to handle them satisfactorily. Rover may also need to learn to behave somewhat differently in the presence of his master than his mistress, success in getting on with these people evidencing his capacity to identify them. His initial ability to distinguish among individual people by smell is probably innate, but coordinating this ability with his abilities to recognize the same people in other ways is more likely learned.

For animals like us that acquire many of their uniceptual abilities through learning or perceptual tuning, a prior ability that may be innate — certainly it is acquired very early — is the ability to track objects with the eyes head and body, also perhaps to track them by sound, and certainly by feel and kinesis. Built in is the implicit assumption that a continuously tracked object remains the same object or kind from the beginning to the end of the tracking process, that tracking is correctly reidentifying over time. Thus the animal is provided with very considerable help in learning how the same object or kind may affect the senses when in different locations relative to the animal, under different

mediating conditions such as lighting conditions, occluding objects, interfering noises and so forth.

Unicepts acquired by a species or by individuals in the above ways, ultimately tested for adequacy by natural selection or by practical learning, are "practical unicepts." Unicepts that can be acquired in this way are quite limited, being always of things that the animal must take account of during guidance of immediate practical activity. Practical unicepts must all be immediately useful in practice, either during the history of the species or in the individual animal's experience.

That nonhuman animals are limited to forming unicepts in this practical way is suggested by many animal studies. Merlin Donald, for example, once summarized the literature on signing in apes as follows: "The use of signing in apes is restricted to situations in which the eliciting stimulus and the reward are clearly specified and present, or at least very close" (1991, p. 152). Indeed, experimental studies of learning in animals invariably proceed by giving a *reward* to the animal that learns to *behave* as the experimenter wants. No one expects a non-human animal to acquire a new unicept — a new concept? — in any other way.

A striking difference in humans is that they acquire unicepts of all kinds of things that they have no use for in practice. Many of these things are such that they could not possibly guide motions directly, being too small, or too large, or too amorphous or too abstract, or too far away, or in the past or distant future. We collect huge quantities of knowledge that we never have and, in many cases, that we never expect to find practical uses for. We wonder about and try to collect knowledge about the stars, about what's inside an animal's mind, about how engines work, about who won the last Boston

marathon, about whether you can square the circle, about what Napoleon did after Elba, about who wrote the Shakespear plays, about how tall various mountains are, about how various cities got their names, and about what causes what and why for almost anything at all (why is the sky blue?). Collecting knowledge that is, at least at the time it is collected, irrelevant to practice, requires developing unicepts of the objects, properties, kinds, events and so forth that this knowledge concerns in some other way, obviously, than through practical test. How is this possible?

My speculation is that coordinated with the development of the use of language, in humans, is the development of a new kind of inner and outer representation, namely, representation that has subject-predicate structure, the predicate being sensitive to a negation transformation. Call this "propositional structure." Contrast, for example, the kind of representation that the honey bee uses. Different bee dances can tell of nectar different places, but there are no bee dances that say where there isn't any nectar. Bee dances are not subject to a negation transformation. A representational system that includes negation is a system that can show right within it, prior to any attempted action it might guide, when errors in identification are occurring. It allows descriptive inconsistencies to emerge explicitly, right on the surface of the representational system. It allows thought (or language) openly to display coherence or incoherence in the ways it is representing the world prior to using those representations in practical activity. The emergence of inconsistencies indicates the need for corrections in the ways that have been being used to form judgments, corrections in ways used to identify subjects and predicates — adjustments, that is, in unicepts.

Donald Davidson held that the only way to corroborate one's ways of recognizing

the selfsame thing again was through agreement with others using the same language. But that one can make the same judgment again from different perspectives, using different sensory modalities, under different mediating circumstances, and also by interpreting different kinds of more distal natural signs, offers similar evidence for the objectivity of unicepts employed in these judgments. Trust in the objective reference of our unicepts is warranted in so far as we agree each with our own selves in these judgments, as well as agreeing with others, who may use other, though often overlapping, methods of identification.

I check my judgment, say, that this is a pencil. by moving in relation to it, by employing various different senses, by manipulating it and so forth, to confirm a constant result. The same object, if I reidentify it correctly, that is square as perceived from here should be square as perceived from there and square by feel and also by checking with a carpenter's square and by measuring its diagonals and, barring certain interferences, square tomorrow. I test each method of recognition against its use on other occasions and against alternative methods of recognizing the same, in doing so confirming the general abilities that constitute, in part, the subject as well as the predicate unicepts used in making my judgment. I confirm these methods again when I find that another person has arrived at the same results, another way of obtaining information about objects and properties being, of course, to believe what one is told. Consistent agreement in results is evidence that my various methods of making the same judgment are all focusing on the same distal affair, bouncing off the same target, as it were. That what I take to be the same substance is found to melt at what I take to be the same temperature by checking with an alcohol thermometer, a mercury

thermometer, a gas thermometer and a bimetal expansion thermometer is evidence both that I am able to recognize the same substance again (a real kind) and that there is indeed some same real quantity (unlike caloric pressure) that all of these instruments are measuring — evidence that the unicepts I am employing are unicepts of something real. In this way "theoretical unicepts" can be formed and evaluated independently of practical activity.

Our ability to form unicepts in this way, prior to and independently of practical uses, hence to acquire huge quantities of purely factual knowledge, later feeds into the governance of our practical activities, separating us quite definitively from other animals.1

Donald, Merlin 1991 Origins of the Modern Mind (Cambridge MA: Harvard University Press).

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1 For much more detail on the subject of unicepts, see my *Unicepts and Root Signs; A Path to Cognition and Language* (forthcoming).