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STYLES OF RATIONALITY

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By whatever general principles and mechanisms animal behavior is governed, human behavior control rides piggyback on top of the same or very similar mechanisms. We have reflexes. We can be conditioned. The movements that make up our smaller actions are mostly caught up in perception-action cycles following perceived Gibsonian affordances. Still, without doubt there are levels of behavior control that are peculiar to humans. Following Aristotle, tradition has it that what is added in humans is rationality ("rational soul"). Rationality, however, can be and has been characterized in many different ways. I am going to speculate about two different kinds of cognitive capacities that we humans seem to have, each of which is at least akin to rationality as Aristotle described it. The first I believe we share with many other animals, the second perhaps with none. Since this session of the conference on rational animals has been designated a "brainstorming" session, I will take philosopher's license, presenting no more than the softest sort of intuitive evidence for these ideas.

Traditionally, the paradigm of human "rational behavior" is taken to be engaging in Aristotelian practical inference. Practical inference is usually described as reasoning in something like the form of a proof: I desire A, doing B will probably lead to A, therefore I'll do B. In reality, however, that is not the way practical reasoning goes at all. Rather, it is the way conclusions are justified to other people. The core of actual practical reasoning processes is not like a proof but like a search for a proof. Just as in

mathematical reasoning you are likely to start with something you would like to prove, in practical reasoning you begin with something you would like to do or to have done and then attempt to construct something like a proof. And how do you construct a proof? This is largely a matter of trial and error. You start with what you would like to prove and work backwards, trying to find plausible steps that might lead to that conclusion, and you start also with things you already know to be true and work forwards to see where these things might lead. You try to fill in the gap between what you find going forward and what you find going backward.

Looked at this way, the emergence of reasoning appears as just one among other examples of the evolution of evolvability, in this case the emergence of a new level of trial and error learning beyond operant conditioning. New levels of trial and error yield quicker ways to adapt organisms to their environments than genic selection. Reasoning is just trial and error in thought. Dennett (1996) calls animals capable of trial and error in thought "Popperian." The reference is to Popper's remark that it is better to let one's hypotheses die in one's stead. The Popperian animal is capable of thinking hypothetically, of considering possibilities without yet fully believing or intending them. The Popperian animal discovers means by which to fulfill its purposes by trial and error with inner representations. It tries things out in its head, which is, of course, quicker and safer than trying them out in the world. It is quicker and safer than either operant conditioning or natural selection.

One of many reasonable interpretations of what it is to be rational is that being rational is being a Popperian animal. The question whether any non-human animals are rational would then be the question whether any of them are Popperian. I suppose the

cash value of the answer to that question is in the neurology. We would need to inspect the mechanics of thought of the various animals, what kinds of inner representations they employ for what purposes. At the moment we have mostly behavioral evidence on these matters, and it is often controversial how much light the behavioral evidence can be made to cast on underlying structures. Still, based on very informal behavioral evidence, I will suggest a certain way in which it seems plausible that both humans and many of the higher animals are indeed Popperian.

So far as I know, rationality has always been assumed to occur only on the level of cognition, as distinguished from the level of perception. However, I suggest that a certain kind of rationality may occur on the level of perception prior to cognition. A difficulty here, of course, is that exactly what the distinction between perception and cognition consists in, indeed, whether there exists such a definite distinction at all, is controversial. For example, perception is generally assumed to include object recognition, which may look rather like the applying of concepts, yet concept application is usually thought of as involving cognition. Both the ventral or "what" visual and auditory systems and the dorsal or "how" systems are generally supposed to be involved in perception (Jeannerod 1997, Norman 200?). Yet recognizing what one sees or hears is also thought of as involving cognition. For simplicity, I will take as paradigmatic of perception the production of representations suitable for guidance of immediate action, suitable because these represent for the perceiving animal its own present relation to various world affairs as needed for action. Perception tells where in relation to the animal certain affordances are exhibited, such as relations to things to be picked up, things to hide from, places to hide, things to climb up on, things to eat, and

so forth. That is, perception of objects, as perception, is for immediate use in practical activity. If perception involves concepts, they are in the first instance practical concepts, repositories for procedural rather than propositional knowledge, for storing know-how rather than factual information.

The perceptual level, so defined, is a level that involves only "pushmi-pullyu representations" (Millikan 1996). These are representations that are undifferentiated between being indicative and being imperative, between describing and directing. The simplest examples of pushmi-pullyu representations are signals and signs used to coordinate behavior among conspecifics. Danger signals, for example, tell in one undifferentiated breath when there is danger nearby and when to run or take cover. Bee dances tell in one undifferentiated breath where there is nectar and where other worker bees are to go. Similarly, perception of a predator, for most animals, is perception of where the danger is and perception of which way to run or to take cover or, if distinctions among various kinds of predators is recognized, of other ways to handle the situation depending on the predator perceived. Similarly, perception of a precipice, of a prey, of water when thirsty, of edible plants, and so forth, are perceptions of affordances, potential guides to things that must or might be done by the animal. Each has a directive aspect as well as a descriptive aspect.

I want to suggest that there is such a thing as mental trial and error, hence rationality, at the perceptual level, so defined. I haven't got any fancy animals such as chimps or dolphins or African grey parrots in my laboratory, but we do have grey squirrels in our yard. And we have a bird feeder that hangs on a chain from well under

the eves above the deck of our house, hung there to keep it out of reach of the grey squirrels. The grey squirrels are not satisfied with this arrangement. Not long ago I watched one eyeing the feeder from the deck. It studied the situation long and hard from one side of the deck, then from the other. It climbed up on the railing to study the situation from there, first from one side, then from the other side, and then from underneath. It eyed the screen on the door that goes out to the deck. Finally it made a try. Starting from a run along the railing, it leap and ricocheted off the screen toward the feeder but missed. Once again it surveyed the situation from various angles, and finally succeeded by hitting the screen a little higher up, then hanging on tight to the whirligig feeder while it wound up, unwound, wound up again and unwound. I hadn't the heart to shoo it away!

Now what was going on in that squirrel's head as it sat up on its haunches, studying and studying from this angle and that? What was going on, I suspect, was a sort of trial and error in perception. It was trying to <u>see</u> a way up, trying to <u>see</u> an affordance. Similarly, when hiking a steep path, you may take a brief moment sometimes to see the best way to get a leg up. Or before crossing a stream on scattered rocks, it may take you a while to see a good way to cross without wetting your feet. This sort of trying to see a way seems entirely different from practical inference as inference is usually described. Surely the squirrel was not thinking in propositional form, doing syllogisms in its head. But if rationality is the capacity to make trials and errors in one's head, it certainly was exhibiting a form of rationality. This form of rationality seems to be common to humans and, I imagine, many other animals as well.

Moving to the other extreme, I want to discuss a second kind of rationality that is

characteristic of humans but that it seems unlikely other animals are capable of. This is the ability to recognize contradictions among representations of facts lying beyond immediate perception and to make corrections in thought accordingly.

My arguments --perhaps I had better say speculations-- will unfold as follows. First, nonhuman animals generally have no interest in facts that don't pertain directly to practical activity. They do not represent or remember dead facts. Second, an important criterion of correct recognition of objects and properties needed for guidance of practical activity is success in these practical activities. Perhaps, then, it is not just that nonhuman animals have no interest in representing dead facts. Perhaps they have no means of developing and testing abilities to recognize objective states of affairs other than through the consequences of practical activities that depend on these recognitional abilities. Third, I suggest that to learn to recognize dead facts requires the ability to use another sort of test of correct recognition of objective objects and properties, hence of objective states of affairs, namely, triangulation, or the convergence or agreement of a variety of different methods of recognizing the same objective state of affairs. But recognizing agreement implies the ability also to recognize disagreement, hence the ability to recognize contradictions in thought. I suggest, fourth, that the emergence of useful contradiction in thought depends on the development of representations in thought (and perhaps in language) that have subject-predicate structure and that are sensitive to internal negation. This structure allows thought openly to display the ways it is representing the world as coherent or incoherent prior to possible uses of those representations in helping to govern behavior. It offers a criterion of correct reidentification of objects and properties that does not depend on success or

failure in practical activity. This development produces a more sophisticated Popperian animal, one that can make trials and errors in its attempts to represent the world prior to risky employment of those representations as guides to action. I suggest that it is unlikely that nonhuman animals are capable of this properly propositional form of mental representation. I will take up these various points in turn.

It is true that nonhuman animals may learn or remember, may systematically store away, knowledge of the layout and of many significant features of the geography of the locales in which they live, knowledge of conditional probabilities among events significant for the animal, knowledge of hundreds of places in which they have cached food, knowledge of the social hierarchy of the group in which they live, and so forth, and that all of these things may be learned prior to use of this information to govern rewarding behavior. But these kinds of knowledge seem all to have been determined in advance by the experience of the species as useful in guiding practical activities of importance for survival. Moreover, this knowledge is typically called on only in contexts in which, according to the experience of the individual or the species, it has immediate uses of predetermined kinds. Nonhuman animals may also collect many skills out of context of immediate use, but again, these skills seem always to be of a kind their evolutionary pasts have shown to be significant. I am thinking here of play, which seems to occur in all mammals at least, but in nonhuman animals seems always to be practice for well-defined species-typical adult activities. Similarly, through rigorous and careful step by step training by humans, individuals of many higher species can laboriously be brought to recognize perceptual affordances of kinds quite remote from any they were specifically designed to learn. Recognizing these affordances may

involve recognizing properties and kinds of objects with no history of relevance to the animal's species. But they seem to be recognized only as things that have proved useful in the individual's previous experience and only as affording those known uses.

What this suggests is that what nonhuman animals actively represent is, primarily or exclusively, affordances. Their active inner representations are primarily pushmi-pullyu representations, rather than representations of dead facts. The other side of this coin would naturally be a failure of the animal to represent what to do dissociated from perceived possibilities of implementation. Pure goals would not be represented torn apart from the perception of affordances directing the animal towards those goals, at the very least, perception of what will support searching behaviors, designed to raise the probability of encounter with more rewarding affordances. Thus the hungry animal perceives aspects of its environment as for traversing, or for sniffing, or for searching with its eyes, these behaviors being designed to bring it into contact with more direct food-tracking affordances, and so forth. Motivation would always be directly grounded in perception, including perception of the animal's interior, of course, of its current needs as well as its current opportunities. Accordingly, Merlin Donald says of the behavior of apes: "complex as it is, [it] seems unreflective, concrete, and situation-bound. Even their uses of signing and their social behavior are immediate, short-term responses to the environment... ...Their lives are lived entirely in the present, as a series of concrete episodes..." (Donald 1991, p. 149) and "..the use of signing by apes is restricted to situations in which the eliciting stimulus, and the reward, are clearly specified and present, or at least very close to the ape at the time of signing" (p. 152). The pushmi-pullyu animal solves only problems posed by immediate

perception. It does so by deciding from among possibilities currently presented in perception, or as known extensions from current perception, as in knowingly moving from a known place toward another place known to afford what the animal curently needs.

Humans, on the other hand, spend a great deal of time collecting both skills and pure facts that no experience, either of the individual or the species, has yet shown to be of any relevance to practical activity. Children practice hula hoops, rubik's cubes, wiggling their ears, cracking their knuckles, standing on their hands, and turning around to make themselves dizzy without falling down. People memorize baseball scores and batting averages and, some of them, time tables for railroads all over the country. They are capable of learning thousands of facts about what has occurred or is occurring at times and in places to which they have no potential access, let alone past or present practical acquaintance. They are curious about what will cause what and why, wholly apart from any envisioned practical applications for this knowledge. They may be curious about how things work, where they came from, what properties and dispositions they have, in a completely disinterested way. And, of course, many of these interests may eventually bear unforseen fruit. The adage is that if you keep a thing for seven years, it will eventually find a use. Having stored enough tools and materials in the attic over the years, some of it is eventually bound to come in handy, granted one is an inventive enough tinker with ideas. Dead facts can come alive. The disposition to collect skills and facts that have no foreseen uses is a disposition that has foreseen uses, foreseen through a history of natural selection.

My task now is to make it plausible that collecting dead facts requires a skill that

is different from those needed for collecting merely live facts, and that this skill plausibly rests on the development of propositional structure in thought and the use of internal or predicate negation. The central idea here is that the ability to recognize or reidentify the same distal object, the same significant kind of distal object, or the same objective distal property again when these are encountered in different perspectives relative to the observer, or evidenced through different intervening media, or evidenced to different senses, is an extremely difficult, far from trivial skill. Learning any kind of practical technique for interacting productively with the environment requires, of course, that one be able recognize the objective features of the situation of action that previously were relevant to success on new occasions. Having discovered a technique for opening hazelnuts or for escaping from foxes is of no use to the red squirrel or its species unless it is possible to recognize on new occasions when a hazel nut has been found or when a fox is encountered. But the variety among proximal stimuli that may indicate the same relevant kind of distal situation is enormous. The capacity to represent, unequivocally, that a hazelnut is present and where, or that a fox is present and where, will typically rest on the capacity to translate a wide diversity of proximal stimuli that may proximally manifest presences of these things into mental representations of univocal affordances.

How does the animal, or the species, learn to select out just those members of the set of proximal stimuli that indicate hazelnut or fox? My suggestion is that when perception is used in the guidance of immediate practical activity, the criterion of correct recognition of affording objects or properties lies in practical successes. Roughly, you are right that this is the same affording object, or kind, or property again if you can

successfully deal with it in the same way again. The proof of the pudding is in the eating. But if this answer is correct, it opens wide a second question. How does a human learn to recognize, through diverse manifestations, new objects, kinds and properties that have, as yet, no practical significance for it?

To find this an interesting question, of course, you have to make some realist assumptions. You have to assume that nature has some say in what can count as the same property again or the same object or the same theoretical kind. Humans are not free to determine randomly what will count as objectively the same thing again when encountered on other occasions. This is evident of course, when reidentifying is for the sake of practical learning. It has been considered more problematic in theoretical as distinguished from practical contexts. In (Millikan 1984, chapters 15-17; Millikan 2000, chapters 1, 2 and 7) I argued for a realist interpretation of basic objects, kinds and properties, and I cannot repeat those arguments here. Rather, I will run on the common sense assumption that the question whether the same individual object has been reencountered usually has an objective answer, and that whether the same property, or at least a property within a close range, has been reencountered generally has an objective answer. And I will assume that there are real kinds. These are not kinds that divide the world of individual objects into mutually exclusive categories. But they are not defined by arbitrary sets of necessary and sufficient properties either. A real kind covers instances that have numerous properties in common for the same underlying reason, for example, because the inner constitution of these instances is the same and numerous superficial properties causally depend on these underlying properties, or because the members of the kind are historically connected, perhaps by having been

reproduced or copied from one another, and so forth (Millikan 2000, Chapter 2).

Thus the question whether the same real kind has been reencountered often has an objective answer. Our question then is how an organism learns to recognize the same objective individual, property, or real kind through the wide diversity of its manifestations to the various senses, through a variety of intervening media, as encountered in a wide variety of different orientations to the organism. The question becomes particularly acute when we notice that humans, unlike nonhuman animals, apparently manage to identify novel kinds of events and states of affairs at huge spatial and temporal distances from them, as in collecting information about historically remote events, or events on the other side of the world or in outer space --or inside atoms.

The correct answer, I suggest, is the traditional one, that the test of truth in theoretical as distinguished from practical knowledge is noncontradiction. Our ability to collect merely theoretical knowledge depends on the disposition to adjust beliefs and methods of identifying used in forming beliefs until these are consistent or, putting this more perspicuously perhaps, until they are stable. This is done by employing as many methods as possible of triangulation, attempting to arrive at the same belief by many methods. If the same belief is confirmed by sight, by touch, by hearing, by testimony, by various inductions one has made and by theories about what ought to be so or at least might be so, this is a good test not only for the objectivity of the belief but for each of the general methods one has employed in identifying and reidentifying the objects, properties, relations and so forth that the belief concerns. The same object that is square as perceived from here should be square as perceived from there and square by feel and square by checking with a carpenter's square and square by measuring its

diagonals. If a person knows French when I find him today, that same person should know French when I find him tomorrow and as inferred from such facts as that he buys Le Mond every Saturday. If Sadie arrived in Germany on March 22 as determined by noting the plane on which she left Boston, she should have been in Germany on March 22 as determined, for example, from what she says later and from what those who went with her say, and from what the immigration records and credit card bills show. That beliefs are reconfirmed by use of a variety of methods for checking their truth is evidence both for the objectivity of their subject matters and for the reliability of the general methods we use in reidentifying the sorts of objects, kinds and properties they concern.

More important than confirmation, however, is that the beliefs formed by these methods tend not be contradicted by further experience. Failure to reconfirm a belief is not evidence against it. If I look again from another angle and fail this time to see that the object is square, this is not evidence against its being square. For perhaps I can't see the object at all, or although I see it, perhaps I can't make out its shape from here or against the light. To have evidence against its being square, first I must see it, and then I must see its shape and then, further, I must see that this shape is some contrary of square, such as round or oblong, and I must understand that round or oblong is incompatible with square. For a judgment to be said to remain stable, it must be possible that it should have been rendered unstable. And this requires that the thinker be capable of recognizing evidence for the truth of its contraries, and grasp that these contraries are incompatible with it.[1]

The upshot, I am suggesting, is that the capacity to learn, out of the context of

practical activity, to recognize what is objectively the same object, kind or property again rests on the capacity to form representations with subject-predicate structure, where certain predicates are understood as contrary to one another[2] so that contradiction is possible. Notice that simple representational systems do not contain contrary representations. Signals used to alert conspecifics to danger, for example, do not have contraries. A dozen danger signals at a dozen times and places do not contradict one another. Perhaps there really is that much danger around. Nor does one bee dance contradict another. There may well be nectar both those places. Similarly, perceptual representations telling of a variety of different affordances at different places do not contradict one another. The animal may not be able to avail itself of all those affordances at once. It may have to make choices. But the perceptual representation of one affordance doesn't contradict the perceptual representation of another.

Perceptual representations don't contradict one another because what is perceived is relations that affording objects and situations have to the perceiver as from here and now. Simply as perceived, what has a particular relation to the perceiver as from here and now is intrinsically unstable. Perceptual representations need to be updated continually. But updating one's perceptions is not changing one's mind. That certain objects and properties are here and there relative to me now does not conflict with there being different objects and properties here and there relative to me at other times. A representation of an affording situation as from here and now is not a representation with an articulate subject term ready to be stored away for potential use or reevaluation on other occasions. Not that a particular time, place and perspective couldn't in principle be a subject of judgment. But to represent a particular time, place

and perspective as a subject of judgment would require that one grasp possible ways of reidentifying that subject, for example, through evidence from the testimony of other people, or through theories by which one attempts to reconstruct past events. This kind of grasp of objective reidentifiable locations in space-time is not given merely in perception.

My suggestion, then, is that the capacity to adjust beliefs until they are consistent, hence the capacity to think in subject-predicate form where the predicate is sensitive to negation, is needed primarily by an animal that reconstructs in thought large portions of its world that it has not yet dealt with in practice. This is a form of rationality that it seems less likely that nonhuman animals achieve.

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1. For much more detail on this subject, see Millikan 1984, Chapters 14-17.

2. On certain grounds. See Millikan 1984 Chapter 16.