The animal spots the orphan egg and rolls it back into the nest. One possible
interpretation of the behavior is that the bird knows what it is about, but a little
discreet tampering with the situation reveals that this is not the case. For
example, the bird will retrieve anything even vaguely round, beer cans and
voleballs for instance, but recognizes them as inappropriate once they are in
the nest and discards them. More striking still, the object may be removed once
the bird has begun the retrieval, and the new "normal" egg will be gently rolled
back into the nest nevertheless. The bird is simply a well-programmed machine.
Faced with complex problems, birds cannot recognize or one more simple
but normally diagnostic cues for "eggsness" and to execute a complicated motor
program in response.

A host of ethologists, beginning with Lorenz, Tinbergen, and von Frisch,
discovered that learning may be programmed to occur only with the appropriate
combination of context, time, and cues, and can be used to build hard-wired
motor programs, once so triggered, many birds learn how to forage, but can learn to
take only one specific kind of prey (Markl, 1970). The bird recognizes its own
song and ignores those of other species on the basis of certain diagnostic cues.
During a critical period in the life of the bird, the song is memorized. Months
later, males begin to practice until they learn to manipulate their vocal muscles in
a way that will produce a good copy. This motor program becomes fixed, so that an
adult male may be deafened without affecting his song.

The lesson from these discoveries is that complex and seemingly inexplicable
behavior may be the consequence of an animal's use of unexpected sensory
windows, elegant programming, or "innate learning." Most of animal behavior
may be explained in this way. We reject those explanations of much of human
behavior, though, in favor of the old idea that our special riches in the world
are one in which things are consciously reasoned out with brute intelligence.
G. raises the ever-intriguing possibility that this strategy may not be confined to
our species - that the creatures which throng the stage of life around us may not
be simply the clever, microcomputer-equipped robots of classical ethology, and
that somewhere inside their brains may be an abstracted self-image, and an
ability to know what they are doing.

By its very nature, the knowledge of what is going on in a mind is private. The
two lessons of ethology mentioned above caution us that mere complexity is not
itself a reliable clue. The novelty of G's approach is that it suggests two general
categories of tests for self-awareness. One sort looks at what animals do when
presented with problems which evolution could not have anticipated, so that any
intelligent output from the animals must represent its own analysis of the problem
rather than evolution's. The other method is to engage in a dialogue of sorts with
the species in question, and to look for self-generated ideas or disembodied
consciousness on the part of the other party. The judgements in either case are
largely intuitive, but so they often are at the leading edge of science (Kuhn, 1952).

G. concentrates on two groups of animals in his arguments: the higher primates,
and the honeybees, each the intellectual apex in their respective phylogies. The
evidence he cites in the first case is already intuitively satisfying, but it is difficult
to imagine consciousness being even possible in bees. Nevertheless, in all fairness
I must admit that there are aspects of bee behavior which, in our present state of
knowledge, tend themselves to the consciousness hypothesis at least as well as
to the robotic theory (reviewed in Gould, 1975, pp. 187-194). For example, during
training with respect to an artificial food source, there comes a point at which bees
come to "catch" on that the experimenter is systematically moving the food
further and further away, and Frisch (1967 op. cit. G, p. 17) recalls instances in
which the trained foragers began to anticipate subsequent moves and to wait for
the feeder at the prescriptive new location. It is not easy for me to imagine a
natural analogue of this situation for which evolution could conceivably have
programmed the bees.

Another example revolves around honeybees' instead of alfalfa. These flowers
possess spring-loaded anthers which give honeybees a rough blow when entered.
Although bumble bees, who evolved to pollinate alfalfa, do not seem to mind,
honeybees, on the other hand, avoid alfalfa religiosly (Lowell, 1963). Placed in
the middle of a field of alfalfa, foraging bees will simply fly tremendous
distances to find alternate food sources. Modern agricultural practices and the
finite though surprisingly long flight range of honeybees, however, often bring the
bees to a grim choice between foraging alfalfa or starving.

In the face of certain starvation, honeybees are said finally to begin foraging
alfalfa, but they rapidly learn to avoid being clubbed. Some bees come to
recognize tripped from unpicked flowers, and frequent only the former, while
others learn to chew a hole in the back of the flower and to rob unpicked
blooms without ever venturing inside (Reinhardt, 1952; Pankiw, 1967). What
has analyzed and solved this problem: evolution, or the bees themselves?
language-experienced Lina does indicate, however, that awareness of arbitrary symbols eventually develops even in chimpanzees, for Lane was immediately able to transfer her tool words from the request to the labeling context without further training.

As Shubin points out, the stage of action-embedding parallels our description of the pure performative stage in child language. In pure performatives, sounds are part of action contexts; sound pattern and referent are not clearly separable. The arbitrary connection between sign and referent does not yet exist. The parallel should not be stretched too far, however; the chimpanzees' requests for tools involve using a word to trigger an action of another person in a specific situation. The chimpanzees' early tool vocabulary is less tied to the animal's own action than the child's pure performative (e.g., saying "bye-bye" while waving). The chimpanzees' vocabulary does appear, however, to be more tied than the child's to the total context in which a new word is introduced. Children seem to have a greater tendency to abstract a part of the context in which a word is introduced. They then use this abstraction as the basis for further use of that word, correct or incorrect. But there may be an earlier stage in which human children do not abstract either:

Piaget (1951) describes the earliest word uses of his children as totally tied to one particular context.

There are, however, a couple of other possible explanations for the chimpanzees' difficulty with labels. From the procedural information presented, it seems as though the chimpanzees had to produce labels in response to a question like "What's this?" (or some other verbally presented request for a name). In the original tool-request situation, in contrast, the chimpanzees were to name the tool in response to a nonverbal situation: seeing a thing placed before them. In our study, we found that a child's spontaneous use of a given semantic function in one-word form occurred first in responses to a nonverbal context, only later in responses to a verbal one. For example, the children in our study could spontaneously label entities before they could use the same words to answer the question "What's this?" If this same progression exists in chimpanzees, it could also explain why labels were so difficult for them to learn under the conditions of this study.

Another possible explanation for the chimpanzees' difficulty in learning object labels lies in the rule of extrinsic versus intrinsic reinforcement in language learning. In the label-learning procedure the chimp was asked to name an object and rewarded with praise or food if correct—an extrinsic reinforcement condition. In the tool-request situation, in contrast, the chimp was given the tool he had named (even if it was the wrong tool for the situation); here, the consequences had an intrinsic relation to the chimp's language behavior. In the naturally occurring language acquisition process of children, extrinsic reinforcement seems to play almost no role at all (e.g., Brown, 1973). At the same time, children's tool language have pointed to the potential importance of intrinsic feedback that gives the child information about what he has been asked to mean (Flynn, 1974). This type of intrinsic feedback is provided in the tool-requesting situation, where the chimp is given a tool corresponding to the name he produces on the computer keyboard. In the object-labeling situation, in contrast, he could be given food as a reinforcer, no matter what object name was produced. If this extrinsic reinforcement was interpreted by the chimp as intrinsic, the procedure could actually be confusing. The chimp might conclude that the referent of blanket, one of the labels in the study, was the food reinforcer. Finally, after-the-fact reinforcement for correct symbolic selection in the label-learning procedure seems to have replaced an initial stage in which symbol and referent are systematically paired, such a stage existing in the tool-request procedures, but not in the object-labeling one.

Each of these different explanations for the greater ease of learning and using vocabulary in the tool-request procedure would have different implications for the language acquisition process in chimpanzees and its comparison with its human analogue. But more information from the authors about the object-learning procedure is needed before it is possible to rule out any particular explanation.

A parallel between chimpanzees and children appears in the concepts implicit in their errors of word use during the acquisition of particular lexical items. Thus, Shubin & Babb report a confusion between words denoting members of the tool category (e.g., between key and stick), but not between tool names and food names. This pattern indicates the functional category "tool" as the basis for the lexical confusion. Similarly, Braunwald (in press) reports examples where her own child spontaneously extends tool names to other tools that lack a similar function (e.g., bros for broom is extended to refer also to dust mops). Function is certainly not the only basis of children's lexical extensions and, in fact, it is often difficult to separate function and form (as in broom/dust mop examples). What is clear, however, is that the surface behavior of child and chimp is not very different in some cases of lexical extension.

Perhaps the most striking parallel between child and chimp is the necessity for a pralunge linguistic sensorimotor understanding of various forms of action and communication for the symbolic encoding of actions and desires to take place. Evidence on this point continues to accumulate for children. For example, using the child's response to offers in order to study the transition from sensorimotor to linguistic communication, we found that offers (of an object or an activity) were initially made by the mother on the sensorimotor level alone, then simultaneously on both the linguistic and sensorimotor levels, and finally on the linguistic level alone (Zukow, Reilly, and Greenfield, in press). Correlatively, at the early stages, children would generally not respond to offers unless all the sensorimotor elements were present (e.g., the mother says "Do you want a cookie?" while holding out the cookie to the child). Response to a linguistic offer depended on having the sensorimotor information simultaneously available. Recently Bruner (personal communication) has found the same pattern of development from sensorimotor to linguistic for the child's expression of requests to the mother. In the intermodal communication experiment reported here, the animal differs from the human child in not having prior experience in which a second chimp fulfilled its requests. Hence, it was necessary for the human experimenter to direct the chimpanzee's attention to the other chimp in order to get the chimp to address his request to another animal. Here the experimenter acted like the mothers in our study, using attention-getting devices to transform initially unsuccessful communications into successful ones.

Those parallels and divergences between the developmental processes of child and chimp are important in establishing the full nature of linguistic communication and in identifying what is uniquely human therein. Knowledge of parallels is also important in preventing premature conclusions about chimpanzee language-learning limitations. When many of the chimp's limitations of today turn out to have been analogous to early stages in the child's acquisition process, we should not be surprised when tomorrow the chimp follows the child in taking the next step on the road to mature linguistic communication.

REFERENCES


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Basic concepts for cognitive ethology. Ethology, as Griffin (1976 op. cit. G. Shubin & Babb has argued, was founded on the logic of behaviorism. But behaviorism was Cartesian dualism with its mental act removed. Now that experimental psychologists, as well as some philosophers, have undertaken investigations that bypass the Cartesian dichotomy and analyze the cognitive powers of animals, including ourselves, without that embarrassing impediment to understanding, the need to articulate adequate concepts to guide such work brings the interests of philosophers into convergence with those of experimentalists.

1. The conversations of Sherman and Austin [SR&B]. Work of the kind reported by SR&B represents not only "a large step" for their experimental animals, but for human theorists as well. Concepts like "intentionality," "propositionality" (from Stedile and Harnad, 1970 op. cit. SR&B, p. 451), "comprehension," and "symbolic representational capacity" should indeed become pivotal to the study of cognition. The context in which they are used and the development of experimental design under their guidance illustrate, for this commentator, the fruitful interaction of theory and experiment that a fresh perspective in science can encourage and offer, at long last, support for the biologically biased epistemologist in the study of animal cognitive behavior. For a philosophical account of intentionality that parallels SR&B's usage, see, for example, Feltesiel (1969) and Searle (1979).

"Awareness" seems to me rather more difficult. Granted, one no longer wants to deny awareness to other animals, any more than to human beings. Granted