

EDITORIAL

Ethology and development

Ethology has two faces. One is seen by those who study animal behaviour scientifically. The other is drawn by popular writers for a larger public. This article is concerned mainly with the first.

What can the science of animal behaviour contribute to our understanding of human development? Man, as Darwin remarked, 'with all his noble qualities . . . still bears in his bodily frame the indelible stamp of his lowly origin'. But the evolution of behaviour cannot be traced, as that of structure can, in the fossil record. Darwin (reprinted 1971) himself published an account of an infant's development; this remarkable study is based on direct observation, not on speculation about the inaccessible past. As Darwin perhaps realized, a full scientific account of behaviour requires knowledge of individual development, from birth or before.

The work of his modern successors has recently been reviewed in two symposia (Jones, 1972; Barnett, 1973). As they show, Darwin's example of detailed observation has been followed, after a long interval, both by clinicians and by biologists.

The close scrutiny of what infants and young children, and their parents, actually do is in contrast with the method used by Freud and his followers. The psychoanalytic account of childhood is based largely on inferences from statements made by adult patients. Although such inferences can sometimes be treated as hypotheses to be tested by direct observation (Kline, 1972), they are not usually thought of in this way.

Ethology can hope to contribute to our understanding of ourselves in three ways. The first is non-logical. A notable example is the celebrated work of a psychiatrist, Bowlby (1969, 1973), on the child's attachment to its mother. His conclusions are explicitly built on an ethological foundation. Nevertheless, they could have been reached, and evidently were first reached, without benefit of ethology. The two components of this great work, zoological and paediatric, are not sequential. Yet the animal behaviour is clearly important to the author. It represents, not a source of formal hypotheses, but a frame of reference, or 'paradigm' (Kuhn, 1970), within which the conclusions are presented.

Those who study human development, whether as teachers or as healers, are likely to look for a more specific contribution from biological science. The second, and most obvious, gift from ethology to other behavioural sciences is procedural. One of the foundations of modern ethology is natural history: what animals do, from moment to moment, is minutely recorded, if possible in natural surroundings. Correspondingly, children are observed with other children and with their parents. The social smiling of infancy was at first examined, by psychologists, as a response to a formal stimulus—a face-like pattern (Fantz, 1967). Ethologists, by contrast, study it as a social phenomenon—that is, as part of an interaction between people, especially within a family at home. Like the species-typical signals of animals, this charming gesture is highly predictable, and is evoked by and provokes specific social situations; it also has evident survival value (Wolff, 1963).

Knowledge thus grows of what may be expected of infants and children at successive ages. One may study, by ethological methods, not only motor and sensory abilities but also development as a social being and perhaps also needs. Tinbergen and Tinbergen (1972) have made a detailed record of the activities of children in their work on Kanner's syndrome, or early childhood autism. Tentative conclusions are that the conduct of normal children often includes autistic elements, and that the latter reflect a conflict between a social impulse, on the one hand, and fear or anxiety engendered by strange people and places, on the other. Analogous conflicts have been supposed to influence the behaviour of other species. The notion of behaviour determined by interaction of opposed impulses—for instance, approach versus withdrawal—has, indeed, had much currency in ethology. The

analogy has evidently led the Tinbergens to make suggestions about the causes of Kanner's syndrome and hence its prevention.

The last statement introduces the third possible contribution from studies of animals, and potentially the most fruitful—namely, the provision of hypotheses. A central question in psychology concerns the relationship of the different conditions of upbringing of children with later development and with adult personality. At present, even reliable correlations are hard to find, let alone evidence of causal relationships. Can the studies of the social development of other species suggest something new about ourselves?

A casual reader of the literature might conclude that this has already been achieved. There is now a substantial mass of information on the effects of early conditions of rearing on at least one species of monkey. It would be satisfactory if this work had led to useful hypotheses about the early life of children; but, in fact, the sequence has so far been mainly in the opposite direction: deprivation of maternal care was first put forward as a source of human psychopathy, only later as something to be studied in other species. Since then, the work on monkeys, especially the rhesus macaque (reviewed by Sackett and Ruppenthal, 1973), has rightly attracted much attention among child psychologists and paediatricians; but it has not told them what to do.

Much the same applies to the famous studies of imprinting, or the learning of parental characteristics by young birds and mammals (reviewed by Bateson, 1971). The behaviour of Mary's little lamb is of great interest, especially when replicated in follow-up studies; but its precise significance (if any) in the analysis of child development has still to be found out.

It would be wrong to suggest that ethologists, in the narrow sense of zoologists who study animal behaviour, have a monopoly of ethological methods. It was experimental psychologists who, after many years of disregard, recognized the importance of exploratory behaviour. They did this, as ethologists might, by looking at what their subjects actually do, instead of merely recording events by means of pen recorders or counters. Many animals, and perhaps all mammals, tend to avoid monotony: especially when they are sated with the prime necessities of life, they move about as if at random and so achieve a varying input through their senses. As a result, their brains incidentally store useful information about their surroundings: the information then enables them to find their way around without hesitation. Moreover, diversity of experience in early life has a profound effect on the ability to solve problems later: laboratory mammals, at least, are more 'intelligent', in a precisely measurable sense, if they have a stimulating early environment instead of a featureless one (reviewed by Barnett, 1975).

Have such findings any significance for human development? We are not justified in drawing, from experiments on animals, any *conclusion* about man; but we may justly base hypotheses on them (Connolly, 1969). White *et al.* (1967) gave young infants special stimulation either by handling or by providing them with extra things to look at. The first led to an increase in visual exploration and in reaching with the arms; the second provoked visual exploration, but reduced the movements of the limbs. Again, a prime question concerns the extent to which varying the conditions of early life can lead to corresponding variations in adult performance.

In another example, Eiseman *et al.* (1973) derived a hypothesis about learning in the classroom from laboratory observations on attention to novel stimuli. In their experiments, illustrating a lesson with 'incongruous' pictures, instead of ordinary, relevant ones, led to better remembering. Whatever we think of this finding, the method used by these authors is an example of a legitimate use of researches on animals in a study of human development.

Ethology's three offerings to the sciences of human development are, then, paradigms, procedures, and programmes. First, it can provide a conceptual frame of reference; but this may be personal to a given author, and belong to the *non-rational* thought processes which lie behind all research (Medawar, 1967). Second, it certainly provides methodological help in the sense of procedures: it encourages direct, naturalistic observation, and it trains people in this difficult art. Third, findings about animals can, in principle, provide testable hypotheses concerning man, and so suggest new programmes of research.

What ethology does not do is provide a *necessary* foundation for developmental psychology or psychiatry; and it certainly does not provide proofs. By contrast, the physical sciences make an essential basis for physiology and its clinical applications. Perhaps some people feel that zoology *ought* to give similar support to the sciences of human behaviour.

This unstated belief may be one source of the excessively kind reception given to some popularizers. These writers, though diverse, have one common central theme: they compare man with other species, and suggest that similarities, often superficial, have an important message for us (Leyhausen, 1965; Lorenz, 1966; Morris, 1967; Eibl-Eibesfeldt, 1972; Tiger and Fox, 1971). The message itself often remains unclear, but it is usually implied that we inherit various propensities or impulses from our remote, pre-human ancestors; hence, regardless of choice or upbringing, certain kinds of conduct are common to our whole species and inevitable or even desirable.

Such an argument is based on a series of fallacies. First, the animal species chosen for comparison are selected in an arbitrary way to fit the prior assumptions of the writer. This was the method of the theologians of the middle ages who wrote the bestiaries: anxious to point a moral, they did not hesitate to adorn a tale. Second, the argument disregards the continual interaction between the individual and the environment that takes place during development. Third, it implies that, like other species, man has a set of species-typical behaviour patterns adapted to a particular type of existence. But the human species has no single habitat or mode; and, even if we guess at a particular way of life for our ancestors of, say, a million years ago, we are not justified in assuming that man has remained genetically static since then. Nor is modern man genetically uniform.

The examples chosen by the modern bestiarists range widely, and include birds. Yet even within a single animal genus there are sometimes marked differences. Hence closely related species may point in opposite directions. Rosenblum (1971) compares the pigtail monkey, *Macaca nemestrina*, with its congener, the bonnet macaque, *M. radiata*. The former, at least in captivity, is notably combative; the female with young keeps apart from others and restrains the exploratory activities of her infant; weaning is harsh. A young monkey that has lost its mother displays initial agitation, followed by 'depression'. If the female returns, the baby clings to her with exceptional tenacity. None of these statements is true of bonnet monkeys: females are gregarious, and allow others to handle even the newborn; weaning is mild; loss of mother leads to searching and then attachment to another adult.

A writer who wished to recommend a punishing method of upbringing might urge us to imitate the pigtail; one concerned to advocate a kinder regimen would prefer the bonnet. But these (and other) observations on macaques would be truly significant for students of human development only if the underlying causes of the different kinds of social interaction were identified, and shown to be operating also in the human family. At present, findings on monkeys are most useful in suggesting the forms that might be taken in further observations of children (Hinde and Spencer-Booth, 1971).

The popularizers nonetheless raise a fundamental question about human development. Smiling, crying, sucking, and some other performances of infancy are universal. To what extent is more complex behaviour—or its underlying impulsion—common to our whole species?

For a valid answer, the question must be correctly put. It is not appropriate to ask whether certain propensities are 'inherited' or 'innate'. Our behaviour, the inner processes that make us act, and our other features are not passed on, by successive generations, like items of property or names. Biological transmission is wholly different from legal inheritance, because every feature is developed anew by each individual. It follows that each characteristic, behavioural or not, is influenced by both the individual's genetical constitution and by the environment. Phenylketonuria is loosely described as an 'inherited' disease, because it has a simple genetical background; but it is also 'caused' by an environmental agent—namely, phenylalanine in the diet. If the environmental component be ignored, an opportunity to treat the condition is lost. What we inherit are genes, not characters.

The human species is genetically extremely diverse; and children, even in a single community, grow up in very different environments. It is reasonable to look hopefully for constant, predictable features in this bewildering variety, but not to present human beings as puppets jerked by genetical or phylogenetic strings.

The notion of features in our conduct irrevocably determined by our evolution is a modern version of the concept of instinct. Today, it is gradually being replaced by examination of what actually happens in individual development. We are therefore faced with a formidable set of problems to which there are no easy solutions. The anxious search for answers to urgent questions must not blind us to the requirements of logic or of argument based on evidence. Ethology cannot solve the problems of human development now, nor is it likely to do so soon. But it may suggest questions that can, with skill and tenacity, be answered.

S. A. BARNETT

REFERENCES

- Barnett, S. A. (ed.) (1973). *Ethology and Development*. Heinemann: London.
- Barnett, S. A. (1975). *The Rat: A Study in Behavior*. University of Chicago Press: Chicago. (In press.)
- Bateson, P. P. G. (1971). Imprinting. In *The Ontogeny of Vertebrate Behavior*, pp. 369–387. Edited by H. Moltz. Academic Press: New York.
- Bowlby, J. (1969). *Attachment and Loss*, vol. 1. Hogarth Press: London.
- Bowlby, J. (1973). *Attachment and Loss*, vol. 2. Hogarth Press: London.
- Connolly, K. (1969). Sensory-motor co-ordination: mechanisms and plans. In *Planning for Better Learning*, pp. 20–36. Edited by P. H. Wolff and R. Mac Keith. *Clinics in Developmental Medicine*, No. 33. Heinemann: London.
- Darwin, C. (1971). A biographical sketch of an infant. *Developmental Medicine and Child Neurology*, 13, Suppl. 24.
- Eibl-Eibesfeldt, I. (1972). *Love and Hate. The Natural History of Behavior Patterns*. Holt: New York.
- Eiseman, M., Sieveking, N. A., and Binkley, M. E. (1973). Use of incongruous materials in classroom learning. *Journal of Genetic Psychology*, 123, 227–230.
- Fantz, R. L. (1967). Visual perception and experience in early infancy: a look at the hidden side of behavior development. In *Early Behavior. Comparative and Developmental Approaches*, pp. 81–224. Edited by H. W. Stevenson, E. H. Hess, and H. L. Rheingold. Wiley: New York.
- Hinde, R. A., and Spencer-Booth, Y. (1971). Effects of brief separation from mother on rhesus monkeys. *Science*, 173, 111–118.
- Jones, N. Blurton (ed.) (1972). *Ethological Studies of Child Behaviour*. Cambridge University Press: London.
- Kline, P. (1972). *Fact and Fantasy in Freudian Theory*. Methuen: London.
- Kuhn, T. S. (1970). *The Structure of Scientific Revolutions*, 2nd edn. University of Chicago Press: Chicago.
- Leyhausen, P. (1965). The sane community—a density problem? *Discovery*, 26, No. 9, 27–33.
- Lorenz, K. (1966). *On Aggression*. Methuen: London.
- Medawar, P. B. (1967). *The Art of the Soluble*. Methuen: London.
- Morris, D. (1967). *The Naked Ape*. Cape: London.
- Rosenblum, L. A. (1971). Infant attachment in monkeys. In *The Origins of Human Social Relations*, pp. 85–113. Edited by H. R. Schaffer. Academic Press: London.
- Sackett, G. P., and Ruppenthal, G. C. (1973). Development of monkeys after varied experiences during infancy. In *Ethology and Development*, pp. 52–87. Edited by S. A. Barnett. *Clinics in Developmental Medicine*, No. 47. Heinemann: London.
- Tiger, L., and Fox, R. (1971). *The Imperial Animal*. Holt: New York.
- Tinbergen, E. A., and Tinbergen, N. (1972). Early childhood autism. An ethological approach. *Zeitschrift für Tierpsychologie*, suppl. 10.
- White, B. L., Castle, P., and Held, R. (1964). Observations on the development of visually-directed reaching. *Child Development*, 35, 349–364.
- Wolff, P. H. (1963). Observations on the early development of smiling. In *Determinants of Infant Behaviour*, vol. 2, pp. 113–138. Edited by B. M. Foss. Methuen: London.