Animal Behaviour

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Preface

Animal behaviour, the concept, broadly considered, referring to everything animals do, including movement and other activities and underlying mental processes. Human fascination with animal behaviour probably extends back millions of years, perhaps even to times before the ancestors of the species became human in the modern sense. Initially, animals were probably observed for practical reasons because early human survival depended on knowledge of animal behaviour. Whether hunting wild game, keeping domesticated animals, or escaping an attacking predator, success required intimateknowledge of an animal's habits. Even today, information about animal behaviour is of considerable importance.

Ethology is a branch of zoology concerned with the study of animal behavior. Ethologists take a comparative approach, studying behaviors ranging from kinship, cooperation, and parental investment, to conflict, sexual selection, and aggression across a variety of species. Today ethology as a disciplinary label has largely been replaced by behavioral ecology and evolutionary psychology. These rapidly growing fields tend to place greater emphasis on social relationships rather than on the individual animal; however, they retain ethology's tradition of fieldwork and its grounding in evolutionary theory.

Although some animals are able to reproduce asexually (such as some insects and a few species of lizards), most animals must find a mate in order to reproduce. In many cases, one of the individuals, usually the male, tries to attract a mate by performing a courtship display. This is often a visual display, as is the case with the peacock and many species of coral reef fish. Studies have shown that the females select males partly on the basis of their courtship displays. Scientists believe that vigorous and brightly colored displays might signal to the female that the male is strong and healthy. Thus, mating behavior plays an important role in determining which genes get passed on to the next generation.

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Feeding behaviour, any action of an animal that is directed toward the procurement of nutrients. The variety of means of procuring food reflects the diversity of foods used and the myriad of animal types. The living cell depends on a virtually uninterrupted supply of materials for its metabolism. In multicellular animals the body fluids surrounding each cell are the immediate source of nutrients. The contents of these fluids are kept at a relatively constant level in spite of tolls taken by the cells, primarily by mobilization of nutrients stored in the body; in vertebrates, for example, glucose is stored in the liver, fats in the fat tissues, calcium in the bones. These stores, however, will become exhausted unless the animal takes up nutrients from outside. Movements performed for this purpose are termed feeding behaviour.

A pheromone is a secreted or excreted chemical factor that triggers a social response in members of the same species. Pheromones are chemicals capable of acting like hormones outside the body of the secreting individual, to impact the behavior of the receiving individuals. There are alarm pheromones, food trail pheromones, sex pheromones, and many others that affect behavior or physiology. Pheromones are used from basic unicellular prokaryotesto complex multicellular eukaryotes. Their use among insects has been particularly well documented. In addition, some vertebrates, plantsand ciliates communicate by using pheromones.

Animal communication is the transfer of information from one or a group of animals (sender or senders) to one or more other animals (receiver or receivers) that affects the current or future behavior of the receivers. Information may be sent intentionally, as in a courtship display, or unintentionally, as in the transfer of scent from predator to prey. Information may be transferred to an "audience" of several receivers. Animal communication is a rapidly growing area of study in disciplines including animal behavior, sociology, neurology and animal cognition. Many aspects of animal behavior, such as symbolic name use, emotional expression, learning and sexual behavior, are being understood in new ways.

The book deals with the behaviour of animals, and gives us wonderful way of each kind of animal's uniqueness in terms of emotional signs and hints of what one animal wants to indicate and to take or to deny through behavioural patterns.

—Dr. Hassan Khalid Azmi

Dr. Iffat

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Contents

Preface (*v*)

1. Introduction **1**
- Branches of Ethology; Important concepts; Methodology; Key principles and concepts; Imprinting is a type of learning behavior; Approaches to the study of Animal behaviour

2. Patterns of Behaviour **7**
- Reproductive Behavior; Types of behavior; Fixed action patterns (FAP); Exploitation; Instinctive behavior; Characteristics of instincts; Difference between instinct (innatea) and learned (acquired) behavior Motivation,Reflexes

3. Behavior Ecology **29**
- Sexual selection; Sexual conflict; Parental care and family conflicts; Mating systems; Social behaviors; Altruism and conflict in social insects; Communication and signaling; Habitat selection

4. Feeding Behavior (Strategies) **56**
- Types Of Food Procurement; Types of feeding; Heterotrophs; Types; Saprotrophs; Symbiosis; Mutation; Commensalism; Parasites; Courtships feeding; Parental Feeding

5. Evolution of Behavior **80**
- Four questions to understand a behavior; Basic Models of Molecular Evolution; Evolution And Animal Behavior

6. Pheromones **90**
- Types; Uses; Pheromones in Insects

7. Perception of the Environment **101**
- Process and terminology; Types; Reality; Theories; Effect of experience; Mechanical Effect; Electrical Effect; Chemical; Olfactory; Auditory; Visual

8. Communication in Animal **127**
- Modes; Autocommunication; Interpretation of animal behaviour; Other aspects; Errors in communication; Chemical; Visual; Audio species specificity of songs

SAMPLE

9. Biological Rhythms **145**
- Introduction to Biological Rhythms; Circannual Rhythms; Circadian Rhythms

10. Migratory Behavior **150**
- What is Migration?; Human History of Animal Migration; Migration in birds; Irruptions and dispersal; Threats and conservation; Navigation, migration in fish; Navigation, migration in Turtle

11. Orientation **179**
- Navigation & Homing; Joneses; Taxes echolocation

12. Social Behavior **191**
- Categorizing the diversity of social behaviour; Aggregation; schooling in fishes; Group selection; Kin selection; Altruism (biology); Reciprocal altruism; Primate Social Organization; Social Life In Primates

13. Reproductive Behavior Patterns **222**
- Basic Concepts And Features; External And Internal Influences; Courtship; Mating; Sexual selection

14. Parental Behavior **231**
- Mammals; Birds; Reptiles; Parental care; In evolutionary biology

15. Individual Behavior **239**
- Conflict; Aggressive; territorial behavior

16. Genetic Basis of Behavior **246**
- Genetic Influences in Animal Behavior; Behavioral Genetics

17. Learning and Memory **254**
- Learning; Imprinting; Language Learning; Memory; Long-lasting Memory

18. Hormones, Drugs and SNF Behavior **268**
- The Theme Of Hormones In Animal Behavior; Hormones in Behavior; Using Animals to Study Mechanisms and Effects of Drugs; Comfort behaviour in animals; Types of Comfort Behaviours

19. Human Ethology **277**
- View on human nature; Human ethology topics; Ethology and Strange Animal Behavior; Comparative Psychology and Ethology

Bibliography **289**

Index **291**

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1 Introduction

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BRANCHES OF ETHOLOGY

Ethology is a branch of zoology concerned with the study of animal behavior. Ethologists take a comparative approach, studying behaviors ranging from kinship, cooperation, and parental investment, to conflict, sexual selection, and aggression across a variety of species. Today *ethology* as a disciplinary label has largely been replaced by behavioral ecology and evolutionary psychology. These rapidly growing fields tend to place greater emphasis on social relationships rather than on the individual animal; however, they retain ethology's tradition of fieldwork and its grounding in evolutionary theory.

The study of animal behavior touches upon the fact that people receive joy from nature and also typically see themselves in a special role as stewards of creation. Behavior is one aspect of the vast diversity of nature that enhances human enjoyment. People are fascinated with the many behaviors of animals, whether the communication "dance" of honeybees, or the hunting behavior of the big cats, or the altruistic behavior of a dolphin. In addition, humans generally see themselves with the responsibility to love and care for nature.

The study of animal behavior also helps people to understand more about themselves. From an evolutionary point of view, organisms of diverse lineages are related through the process of descent with modification. From a religious point of view, human also stand as "microcosms of nature". Thus, the understanding of animals helps to better understand ourselves.

Ethologists engage in hypothesis-driven experimental investigation, often in the field. This combination of lab work with field study reflects an important conceptual underpinning of the discipline: behavior is assumed to be *adaptive*; i.e., something that makes it better suited in its environment and consequently improves its chances of survival and reproductive success.

Ethology emerged as a discrete discipline in the 1920s, through the efforts of Konrad Lorenz, Karl von Frisch, and Niko Tinbergen, who were jointly awarded the 1973 Nobel

Prize in Physiology or Medicine for their contributions to the study of behavior. They were in turn influenced by the foundational work of, among others, ornithologists Oskar Heinroth and Julian Huxley and the American myrmecologist (study of ants) William Morton Wheeler, who popularized the term *ethology* in a seminal 1902 paper.

IMPORTANT CONCEPTS

One of the key ideas of classical ethology is the concept of fixed action patterns (FAPs). FAPs are stereotyped behaviors that occur in a predictable, inflexible sequence in response to an identifiable stimulus from the environment.

For example, at the sight of a displaced egg near the nest, the greylag goose *(Anser anser)* will roll the egg back to the others with its beak. If the egg is removed, the animal continues to engage in egg-rolling behavior, pulling its head back as if an imaginary egg is still being maneuvered by the underside of its beak. It will also attempt to move other egg-shaped objects, such as a golf ball, doorknob, or even an egg too large to have been laid by the goose itself (Tinbergen 1991).

Another important concept is *filial imprinting*, a form of learning that occurs in young animals, usually during a critical, formative period of their lives. During imprinting, a young animal learns to direct some of its social responses to a parent or sibling.

Despite its valuable contributions to the study of animal behavior, classical ethology also spawned problematic general theories that viewed even complex behaviors as genetically hardwired (i.e., *innate* or *instinctive*). Models of behavior have since been revised to account for more flexible decision-making processes (Barnard 2003).

METHODOLOGY

Tinbergen's four questions for ethologists

The practice of ethological investigation is rooted in hypothesis-driven experimentation. Lorenz's collaborator, Niko Tinbergen, argued that ethologists should consider the following categories when attempting to formulate a hypothesis that explains any instance of behavior:

- Function: How does the behavior impact the animal's chance of survival and reproduction?
- Mechanism: What are the stimuli that elicit the response? How has the response been modified by recent learning?
- Development: How does the behavior change with age? What early experiences are necessary for the behavior to be demonstrated?
- Evolutionary history: How does the behavior compare with similar behavior in related species? How might the behavior have arisen through the evolutionary development of the species, genus, or group?

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The four questions are meant to be complementary, revealing various facets of the motives underlying a given behavior.

Using fieldwork to test hypotheses

As an example of how an ethologist might approach a question about animal behavior, consider the study of hearing in an echolocating bat. A species of bat may use frequency chirps to probe the environment while in flight. A traditional neuroscientific study of the auditory system of the bat would involve anesthetizing it, performing a craniotomy to insert recording electrodes in its brain, and then recording neural responses to pure tone stimuli played from loudspeakers. In contrast, an ideal ethological study would attempt to replicate the natural conditions of the animal as closely as possible. It would involve recording from the animal's brain while it is awake, producing its natural calls while performing a behavior such as insect capture.

KEY PRINCIPLES AND CONCEPTS

Behaviors are adaptive responses to natural selection

Because ethology is understood as a branch of biology, ethologists have been particularly concerned with the evolution of behavior and the understanding of behavior in terms of the theory of natural selection. In one sense, the first modern ethologist was Charles Darwin, whose book *The Expression of the Emotions in Man and Animals* (1872) has influenced many ethologists. (Darwin's protégé George Romanes became one of the founders of comparative psychology, positing a similarity of cognitive processes and mechanisms between animals and humans.)

Note, however, that this concept is necessarily speculative. Behaviors are not found as fossils and cannot be traced through the geological strata. And concrete evidence for the theory of modification by natural selection is limited to microevolution—that is, evolution at or below the level of species. The evidence that natural selection directs changes on the macroevolutionary level necessarily involves extrapolation from these evidences on the microevolutionary level. Thus, although scientists frequently allude to a particular behavior having evolved by natural selection in response to a particular environment, this involves speculation as opposed to concrete evidence.

Animals use fixed action patterns in communication

As mentioned above, a *fixed action pattern (FAP)* is an instinctive behavioral sequence produced by a neural network known as the *innate releasing mechanism* in response to an external sensory stimulus called the *sign stimulus* or *releaser.* Once identified by ethologists, FAPs can be compared across species, allowing them to contrast similarities and differences in behavior with similarities and differences in form (morphology).

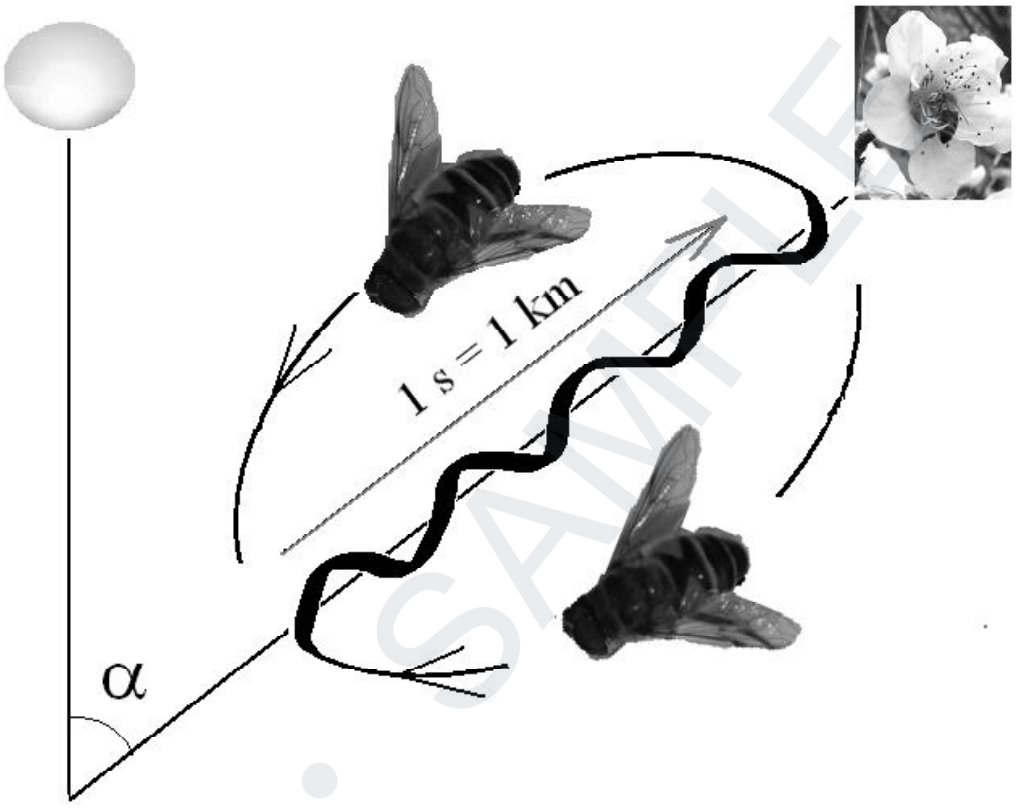


Fig. The honeybee's figure-eight dance is a fixed-action pattern that communicates information to other members of the group: the angle from the sun indicates the direction of a food source; the duration signifies its distance.

An example of how FAPs work in animal communication is the classic investigation by Austrian ethologist Karl von Frisch of the so-called "dance language" underlying bee communication. The dance is a mechanism for successful foragers to recruit members of the colony to new sources of nectar or pollen.

IMPRINTING IS A TYPE OF LEARNING BEHAVIOR

Imprinting describes any kind of phase-sensitive learning (i.e., learning that occurs at a particular age or life stage) during which an animal learns the characteristics of some stimulus, which is therefore said to be "imprinted" onto the subject.

The best known form of imprinting is *filial imprinting,* in which a young animal learns the characteristics of its parent. Lorenz observed that the young of waterfowl such as geese spontaneously followed their mothers from almost the first day after they were hatched. Lorenz demonstrated how incubator-hatched geese would imprint on the first suitable moving stimulus they saw within what he called a critical period of about 36

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hours shortly after hatching. Most famously, the goslings would imprint on Lorenz himself (more specifically, on his wading boots).

Sexual imprinting, which occurs at a later stage of development, is the process by which a young animal learns the characteristics of a desirable mate. For example, male zebra finches appear to prefer mates with the appearance of the female bird that rears them, rather than mates of their own type (Immelmann 1972). *Reverse* sexual imprinting has also observed: when two individuals live in close domestic proximity during their early years, both are desensitized to later sexual attraction. This phenomenon, known as the *Westermarck effect,* has probably evolved to suppress inbreeding.

Relation to comparative psychology

In order to summarize the defining features of ethology, it might be helpful to compare classical ethology to early work in comparative psychology, an alternative approach to the study of animal behavior that also emerged in the early 20th century. The rivalry between these two fields stemmed in part from disciplinary politics: ethology, which had developed in Europe, failed to gain a strong foothold in North America, where comparative psychology was dominant.

Broadly speaking, comparative psychology studies general processes, while ethology focuses on adaptive specialization. The two approaches are complementary rather than competitive, but they do lead to different perspectives and sometimes to conflicts of opinion about matters of substance:

- Comparative psychology construes its study as a branch of psychology rather than as an outgrowth of biology. Thus, where comparative psychology sees the study of animal behavior in the context of what is known about human psychology, ethology situates animal behavior in the context of what is known about animal anatomy, physiology, neurobiology, and phylogenetic history.
- Comparative psychologists are interested more in similarities than differences in behavior; they are seeking general laws of behavior, especially relating to development, which can then be applied to all animal species, including humans. Hence, early comparative psychologists concentrated on gaining extensive knowledge of the behavior of a few species, while ethologists were more interested in gaining knowledge of behavior in a wide range of species in order to be able to make principled comparisons across taxonomic groups.
- Comparative psychologists focused primarily on lab experiments involving a handful of species, mainly rats and pigeons, whereas ethologists concentrated on behavior in natural situations.

Since the 1970s, however, animal behavior has become an integrated discipline, with comparative psychologists and ethological animal behaviorists working on similar problems and publishing side by side in the same journals.

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Recent developments in the field

In 1970, the English ethologist John H. Crook published an important paper in which he distinguished *comparative ethology* from *social ethology*. He argued that the ethological studies published to date had focused on the former approach—looking at animals as individuals—whereas in the future ethologists would need to concentrate on the social behavior of animal groups.

Since the appearance of E. O. Wilson's seminal book *Sociobiology: The New Synthesis* in 1975, ethology has indeed been much more concerned with the social aspects of behavior, such as phenotypic altruism and cooperation. Research has also been driven by a more sophisticated version of evolutionary theory associated with Wilson and Richard Dawkins.

Furthermore, a substantial rapprochement with comparative psychology has occurred, so the modern scientific study of behavior offers a more or less seamless spectrum of approaches—from animal cognition to comparative psychology, ethology, and behavioral ecology. *Evolutionary psychology*, an extension of behavioral ecology, looks at commonalities of cognitive processes in humans and other animals as we might expect natural selection to have shaped them. Another promising subfield is *neuroethology*, concerned with how the structure and functioning of the brain controls behavior and makes learning possible.

APPROACHES TO THE STUDY OF ANIMAL BEHAVIOUR

If we attempt to distinguish among the fields of ethology, animal behavior, comparative psychology, and behavioral ecology this might be the result:

Ethology-work focused on Tinbergen's four primary issues (causation, ontogeny, evolution, survival value); studies tend to be more oriented to observation and natural history. Major scientific journals in this field are *Ethology* and *Behaviour*.

Animal behavior-the study of mechanisms which underly the behavior of animals, particularly as the behavior relates to function in a field setting. The major scientific journal emphasizing this type of work is *Animal Behaviour*.

Comparative psychology-the use of non-human animals as models for the understanding of behavior that is relevant to human behavior. Classically, comparative psychology focuses on issues like learning, behavioral endocrinology, and behavioral neurobiology. The most commonly used model systems are mice, rats, pigeons, and various species of monkey. Work along these lines is found in the scientific journals *Journal of Comparative Psychology* and *Animal Learning and Behavior*.

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Patterns of Behaviour

There are millions of different species of animals, and each species behaves somewhat differently. Nevertheless, there are common patterns of behavior exhibited by many species, and a few behavior patterns that are exhibited by all species. Since all species need to reproduce, eat, and try not to be eaten by someone else, all species exhibit some type of reproductive behavior, foraging (eating) behavior, and defensive behavior. Over time, natural selection has also favored other behavior patterns that help species accomplish these basic goals, including communication behavior, territorial behavior, dispersal behavior, and social behavior.



Fig.Common patterns of behavior are exhibited by many species.

REPRODUCTIVE BEHAVIOR

Although some animals are able to reproduce asexually (such as some insects and a few species of lizards), most animals must find a mate in order to reproduce. In many cases, one of the individuals, usually the male, tries to attract a mate by performing a courtship display. This is often a visual display, as is the case with the peacock and many species of coral reef fish. Studies have shown that the females select males partly on the basis of their courtship displays. Scientists believe that vigorous and brightly colored

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displays might signal to the female that the male is strong and healthy. Thus, mating behavior plays an important role in determining which genes get passed on to the next generation.

Foraging Behavior

Animals exhibit several different types of foraging behavior. Some animals are quite selective in what they eat. These animals are called foraging specialists. For example, the diet of the lynx consists primarily of snowshoe hares. Some species of insects feed only on a single plant species; they are the ultimate feeding specialists. Other animals are generalists, eating a wide variety of food types.

An example of a foraging generalist is the opossum, which eats everything from insects and berries to garbage. It is thought that natural selection has favored many animals to forage in an efficient manner. This means that the animals make feeding choices that maximize the amount of energy they can obtain in the shortest time possible. This type of foraging, sometimes referred to as "optimal foraging," leaves the animal with more time and energy for other important activities, such as finding a mate or caring for offspring.

Defensive Behavior

Virtually all animals are vulnerable to predation (being eaten by another animal) at least some time during their lives. Even wolves and lions can be prey for other animals when they are very young. As a result, animals from worms to whales have evolved ways to reduce the likelihood they are eaten.

This behavior, often referred to as defensive, or antipredator, behavior, can take many forms. Some animals, such as many mothsand lizards, try to blend in with their surroundings so the predator cannot see them.

This is called cryptic behavior. Other species have evolved effective escape behaviors, such as fast-running antelope and fast-swimming fish. Others fight back with stinging or biting behavior. In many cases, prey can deter predators with a threat display. Threat displays are special behaviors that tell the predator that the prey may fight back ferociously. A raccoon that bares its teeth and growls when cornered by a predator is giving such a threat display.

Communication Behavior

As illustrated above, effective communication behavior is vital for an animal. Besides communicating with sight and sound, some animals communicate using chemicals. For example, male moths find mates bydetecting special chemicals called pheromones that the females release into the air. Ants also use pheromones to determine if another ant is an intruder or a member of the colony.

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