



Suma Psicológica

ISSN: 0121-4381

sumapsi@konradlorenz.edu.co

Fundación Universitaria Konrad Lorenz

Colombia

Moreno, Carlos B.; Muñoz-Delgado, Jairo
AN ACCOUNT ON THE HISTORY OF ETHOLOGY
Suma Psicológica, vol. 14, núm. 2, septiembre, 2007, pp. 213-224
Fundación Universitaria Konrad Lorenz
Bogotá, Colombia

Available in: <http://www.redalyc.org/articulo.oa?id=134216871001>

- How to cite
- Complete issue
- More information about this article
- Journal's homepage in redalyc.org

redalyc.org

Scientific Information System

Network of Scientific Journals from Latin America, the Caribbean, Spain and Portugal

Non-profit academic project, developed under the open access initiative

AN ACCOUNT ON THE HISTORY OF ETHOLOGY

Carlos B. Moreno*

Universidad del Rosario, Colombia

Jairo Muñoz-Delgado**

UNAM, México

ABSTRACT

Ethology has been traditionally defined as “the biological study of behavior”. Although its initial studies go back to the second half of the XIX century, its acknowledgement as a scientific discipline dates only from 1973, when the Nobel Prize for Medicine and Physiology is awarded to three of its most outstanding representatives: Konrad Lorenz, Niko Tinbergen and Karl von Frisch. In this text a journey that includes the main historical landmarks of ethology will be undertaken, making special emphasis on conceptual and theoretical aspects. A revision of the background that allows the establishment of ethology as a discipline will be made, as well as a view of its development

* *Professor of Neuroscience, Neuroscience Group (NEUROS), Faculty of Medicine, Universidad del Rosario, Bogotá, Colombia. ISHE (International Society for Human Ethology) member. Correspondence: Carlos B. Moreno and/or*

Address: Grupo de Neurociencias, Instituto de Ciencias Básicas, Facultad de Medicina, Universidad del Rosario, Carrera 24, calle 63D, Quinta de Mutis, Bogotá, DC. Colombia. E-mail: camobe@estudioscaos.com

** *Chronoecology and Human Ethology, Department of Ethology, Division of Neurosciences, Instituto Nacional de Psiquiatría Ramón de la Fuente Muñiz, México, D.F. Psychology Faculty, UNAM. Correspondence: Jairo Muñoz-Delgado*

Address: Instituto Nacional de Psiquiatría Ramón de la Fuente. Dirección de Neurociencias. Avenida México-Xochimilco 101, San Lorenzo-Huipulco, CP. 14370, delegación Tlalpan, México, D.F. e-mail: munozd@imp.edu.mx

and maturity. Finally, the birth of the subdivision known as Human Ethology together with its contemporary tendencies will be addressed.

Key words: *Classic ethology, human ethology, urban ethology, animal behaviour*

RESUMEN

La Etología se ha definido tradicionalmente como «el estudio biológico del comportamiento». Aunque sus estudios iniciales surgen desde la segunda mitad del siglo XIX, su reconocimiento como disciplina científica se fecha solamente a partir de 1973, cuando el premio Nobel para la Medicina y la Fisiología se concede a tres de sus representantes más excepcionales: Konrad Lorenz, Niko Tinbergen y Karl von Frisch. En este texto, se emprende un viaje que incluye las señales históricas principales de la Etología, con un énfasis especial en los aspectos conceptuales y teóricos. Esta revisión ilustra el establecimiento de la Etología como disciplina, así como una visión de su desarrollo y madurez. Finalmente, se analiza el nacimiento de la subdivisión conocida como etología humana junto con sus tendencias contemporáneas.

Palabras Clave: *Etología clásica, Etología humana, Etología urbana, Comportamiento animal*

The term *ethology* takes various acceptations before it is employed in its current form. The word originates from the Greek word *ethos* having various meanings, but it can be adequately translated into “character”, indicating some distinction or peculiarity of a person or animal or, in the sense of moral character, as a result of a habit (Jaynes, 1969).

In the XVII century an actor or mimic is known as an ethologist, since he portrays human characters in the theater. But in the XVIII century, ethology is “the science of ethics” and ethologist the person studying this

science. The English philosopher and economist John Stuart Mill, in the second volume of his work *Logic* in 1893, considers ethology to be “the science corresponding to the act of educating, in its wider sense, including the formation of national and collective characters, as well as the individual one”.

While this is taking place in England, Isidore Geoffroy-Saint-Hilaire, in France in 1859, uses the word ethology in quite an informal manner to refer to an extensive classification of biology associated with the study of animals not as “inert beings kept in

formaldehyde”, but as living organisms in their natural environment. Around this time, in 1857, Ernst Haeckel introduces the term *ecology* and defines it as “the relation of a living organism with its environment (Haeckel, 1898). This term gains wide acceptance toward the end of the XIX century, whereas that of ethology comes to the brink of disappearance. Alfred Giard, an important French biologist teaching at the Sorbonne, starts using with increasing frequency the word ethology in the 1870s in reference to those studies relating a living organism to its immediate habitat.

During the first years of the XX century, the use of the term is restricted to the study of animal behavior in its natural environment, thus marking a difference with comparative psychology and especially with classic behavioral studies emphasizing learning under controlled laboratory conditions.

FORERUNNERS

A rapid retrospective look into the history of biology allows us to identify various scholars who render descriptions of various aspects of animal behavior, in what it may be considered a pre-history of ethology.

Possibly, the first one is Aristotle (384-322/21 B.C). This natural philosopher, who bequeaths biology with several fundamental concepts, writes various treatises dealing with natural history during his last 12 years of existence; we can mention among them: *History of animals*, *On the parts of the animals*, *The movement of*

animals, *The walking of animals* and *On the generation of animals*.

The first document is an enumeration of observations on comparative anatomy, reproductive functions, locomotion and sensory aspects of several animal species; all the texts contain descriptions and classification elements. Aristotle utilizes the comparative approach, provides reasoning by analogy, verifies conclusions and extends his studies to all the circumstances of animal life: ways of living, habits, diseases, influence of climate, etc. In his work *On the generation of animals*, he gives an account of the genders, copulation, fecundation, embryology, birth, heredity, and care given to young individuals. Aristotle must be admired for the accurate description of observed facts, the vastness of his knowledge and his theoretical constructions. For instance, in his treatises he mentions 495 different species that he observed himself; he always avoided the reference of animals he did not know directly.

During the Hellenic and Roman periods, the study of animals suffers a real decadence. The interest of the majority of studies is centered in man, astronomy, mathematics, and physics; an exception is the work of Claudius Eliano (circa 170-249 A.D.): *History of Animals*. In this treatise, the author describes the behavior of animals in the three elements (water, earth and air), with the intention of showing that animals fulfill completely their own aims, unlike

what occurs very often with humans. On the other hand, for the Arabs, natural sciences, in the proper sense of the word, are only auxiliaries to agriculture and medicine, that is, they are considered practical arts. This is the reason of the lack of documented evidence on observations of animal behavior for several centuries.

In the XIII century, possibly coinciding with the teachings of Saint Francis of Assisi (1181-1226), a significant change in attitude toward nature takes place, particularly in reference to animals. Albertus Magnus (1200?-1280), known as the Universal Doctor, writes an extensive work called *De animalibus*, which consists of 26 books gathering original observations on, for example, the description on how a spider weaves its net, or how an ant, having one of its antennae severed, is incapable of returning to its nest without the help of its companions (Taton, 1957).

In the XVI century, naturalists, such as Aldrovani, Gesner and Turner, make important descriptions of various animal species; in their work they add fantastic details as well as the description of some beasts entirely imaginary.

In the XVII century, the English botanist and zoologist John Ray publishes diverse studies on animals. These studies, besides providing important achievements in taxonomy, propound the author's ideas on instinct, conscience and intelligence. These conceptions, in the opinion of other scholars, have the same worth

when compared to the ideas postulated by current comparative psychologists. In this manner, for example, he writes in relation to instinctive behavior: "birds of the same class make their nests of the same material, build them in the same order and give them the same shape, for on seeing the nest one can know with certainty to which type of bird it belongs; birds are able to do it even though they have never seen a nest before or made one, that is, even though they had been snatched from it and brought up outside of it" (Thorpe, 1982).

In the XVIII, the seedling of ethology starts germinating in France. Georges Leroy (1723-1789) publishes, in 1764, *The intelligence and the affectability of animals from a philosophical point of view, with a few words on Man*. The book is written as epistles for her friend Madame d'Angiviller; here he states that "in the study of animals isolated facts must be excluded. What constitutes the true field of observation lies in their daily behavior, the set of all their acts with underlying modifications in accordance with the circumstances, all collaborating toward the objectives that must necessarily keep present, each according to its own nature". Given the relevance of his studies, he is considered the spiritual founder of comparative behavioral studies in Europe.

The first half of the XIX century is prone for the entrance to scene of ethology into the European academic world starting from the studies of Etienne Geoffroy-Saint-Hilaire,

distinguished naturalist, father of Isidore (mentioned previously), whose central hypothesis is the unity of a composition plan throughout all species. Even though he is a collaborator of Baron Cuvier, he engages in a debate with this scholar in the Academy of Sciences of Paris in 1830, vindicating the importance of studying living organisms in their natural environment and not in the laboratory, far from their habitat.

However, all these descriptive studies of animal behavior lack a frame of reference such as the one introduced by Charles Darwin, in 1859, in his *Origin of Species*: the theory of evolution by means of natural selection. Darwin, besides his classic works on evolution, writes among other things two studies that may be considered the first true ethological publications, given its comparative view and the observational technique used; the latter characterized by the non-modification of the environment and a lack of control of the variables. The first work is called *The expression of the emotions in man and animals* (1873). The second provides a short description on the behavior of one of his sons during his first year of age and is published in the journal *Mind: Quarterly Review of Psychology and Philosophy* in 1877; thirty seven years after the pertinent observations were made. This last work is translated and published in Spanish in 1983 and entitled: *Biographical Sketch of a Boy* (*Apunte Biográfico de un Niño*, in

Spanish). Undoubtedly, the fundamental contribution of Darwin to the comparative study of behavior resides in the first of these works. In this study he describes the main expressive actions of man and some animals and establishes the three basic principles of emotional expression: (1) Principle of associated and useful habits, (2) Antithesis principle, and (3) Principle of the actions given the nature of the Nervous System, totally independent of will and in a certain measure independent of habit as well.

In the United States of America, during the final years of the XIX century and beginnings of the next, various distinguished naturalists pave the way for the posterior development of ethology. Among them Charles Otis Whitman (1842-1910) generates his classical studies on the behavior of doves; these studies are published posthumously in 1919. His disciple, Wallace Craig (1876-1954) studies the behavior of doves raised in isolation and that of doves learning to drink. His basic contributions are related to the concepts of appetite and aversion and their relation to instinct (Craig, 1918). Other distinguished American zoologist known for his studies in behavior is William Morton Wheeler (1865-1937); he is possibly the first English speaking author to use the term *ethology* in its current sense. Wheeler makes important observations on the behavior of insects and their mechanisms of evolution (Wheeler, 1923).

Around this same time, in Europe, the relevant task of Oskar Heinroth (1871-1945) lies in demonstrating that behavioral patterns, mainly in birds, may be used as evidence of systematic relationships among species; he also sets the basis for the study of the evolution of such characters. It must be emphasized that Lorenz considers the work of Heinroth one of his main sources of inspiration.

In addition, it is important to mention Jakob von Uexküll (1864-1944), who is one of the founders of invertebrate physiology; he introduces the concept *Umwelt* in biology to refer to the perceptual subjective world of the individual in every species.

THE STUDY OF INSTINCT

The actual consolidation of ethology as a scientific discipline is undoubtedly due to the joint work of two Europeans: Konrad Lorenz and Niko Tinbergen. Their mutual collaboration originates experimental work as well as the development of a solid theoretical framework pertaining to the biological basis of instinctive behavior in various animal species —insects, fish and birds— in their natural environment.

Unfortunately, the Second World War interrupts this fruitful collaboration for the team is disintegrated with the detention of Tinbergen and the recruitment of Lorenz as physician for the German army and his posterior confinement in a prisoner's camp by the Soviets. However, their contributions are acknowledged by the

international scientific community by awarding them the Nobel Prize in Medicine and Physiology in 1973, together with Karl von Frisch (1886-1983). The latter, an Austrian naturalist, is well known for his behavioral studies especially in bee communication.

Konrad Zacharias Lorenz is born in Vienna on november 7, 1903 and dies in the same city on February 27, 1989. He studies medicine and gets a PhD degree in Comparative Anatomy in Vienna, under the supervision of Ferdinand Hochstetter, embryologist and comparative anatomist. In his acceptance speech entitled: *Analogy as a Source of Knowledge* delivered on December 12, 1973 during the Nobel Prize ceremony, Lorenz states: "I had the benefit of a very mindful instruction concerning the methodological procedure to distinguish similarities due to a common ancestor from those owing to parallel adaptation... Perhaps I should mention here that this procedure has driven me to what I personally consider my greatest contribution to science. By knowing animal behavior the way I did, and having been instructed in methods of phylogenetic comparison as I was, I could not fail to discover that the same methods of comparison, the same concepts of analogy and homology are equally applicable to behavioral traits as to morphology".

In 1940, Lorenz is appointed Professor of Psychology in the University of Königsberg (today Kaliningrad), the city where Kant was born and died. A year later, he is recruited as physician

for the German army. Toward the end of the Second World War he is captured and imprisoned by the Soviets for nearly four years. During his confinement, he writes a book on theoretical aspects of biology; his privileged memory and scraps of paper from cement sacks used for construction are his tools in this undertaking. The text is found after his death and published recently with the name *The Russian manuscript*. After his release, he returns to Austria in 1948.

In 1955 he is appointed Director of the Institute of Behavior Studies of the Max Planck Society initially located in Buldern (Westphalia) and transferred later to Seewiesen, south of Germany, where he stays until his retirement in 1973; on this same year he is awarded the Nobel Prize. Lorenz dies in Vienna on February 27, 1989.

Nikolas Tinbergen, better known as Niko, is recognized along with Konrad Lorenz as the founder of modern ethology. He is born in The Hague (Netherlands) on April 15, 1907. He studies biology in Leiden, where he starts his career as teacher and researcher, being appointed assistant in the Zoology Department in 1931. Tinbergen is remarkably skillful in the design of experiments within the natural environment. His first studies are related to the behaviors of nest building and caring in species of solitary wasps; he also describes in seagulls the rearing behavior of their young. In 1938, Lorenz invites him to work in collaboration in Altenberg, the

place where they carry their joint research when the Second World War starts; this event ends their collaboration. Niko is made prisoner by the Germans and confined into a hostage camp in the Netherlands until the end of the war. Once released, he is able to continue with his research in Leiden. In 1949, he is granted a job as lecturer in zoology by Oxford University in England, with the mission of developing a research group in animal behavior. In 1951, he publishes his classic work *The Study of Instinct*. He also participates in the production of various programs and documentaries for the BBC, dealing with animal behavior. Between 1966 and 1974, he receives a professorship in animal behavior by Oxford University. In 1973, he is granted the Noble Prize, and in that same year publishes the book *Autistic Children*. Tinbergen dies in Oxford on December 21, 1988.

The few years Lorenz and Tinbergen work together originate an important effect on the development of the research concerning animal behavior and allow the consolidation of a European school of ethology, whose results are summarized in the book by Tinbergen: *The Study of Instinct*. This book comes as a result of a series of lectures delivered in New York in February, 1947, under the auspices of Columbia University and the Natural History Museum. In the text, Tinbergen introduces the basic concepts of ethology and the results obtained up to that moment from

biological studies in instinctive behaviors; in it he also relates neurophysiology to ethology and reviews some aspects on ontogeny, evolution and adaptability of behavior. The European school of ethology is at this time characterized by an emphasis on the study of instinctive behavior, that is, those behavioral patterns pertaining to a determined species, not requiring previous training or learning to be expressed. Besides, studies of these behaviors in different animal species within their natural environment, without disturbing the animal or modifying environmental variables are strongly supported. Most of these researchers are zoologists coming from Central Europe and their scientific publications are written originally in German.

The European school of ethology makes quite a contrast with the research of comparative psychology that prevails around this time in the United States, viz, their laboratory studies are rigorously designed with strict control over variables, center in learning, and using mostly a single species –the white rat *Rattus norvegicus* albino variety. These investigations are supported by a strong empiricism and behaviorist tradition that consider all behaviors a result of a learning process; their studies are mainly published in English. To these theoretical and practical aspects, strong antagonistic political differences must be added between Germany and England and its

allies, which are exacerbated with the development of the Second World War.

As a consequence of the former, the controversies between comparative psychology and ethology in relation to animal behavior are bitter during the XX century and generate more heat than useful energy. The lectures delivered by Tinbergen and his book *The Study of Instinct* contribute to soften these conflicts.

SYNTHESIS BETWEEN ETHOLOGY AND COMPARATIVE PSYCHOLOGY

This war —verbal and theoretical— between ethologists and comparative psychologists is finally overcome thanks to the intervention of some researchers of animal behavior who consider that the approaches and theories of both schools are necessary and complementary for the understanding of behavior.

Robert A. Hinde, member of the sub-department of Animal Behavior in Cambridge, England publishes a text in 1966 entitled: *Animal Behaviour*. This book has as subtitle: “A synthesis of ethology and comparative psychology; his author manifests in this work his interest in reviewing the area “where psychology, physiology and ethology are superimposed”. Hinde considers disadvantageous to draw a rigid distinction among the interests of these three disciplines, since several benefits may be obtained from the “marriage“ between the ethological point of view and the detailed analysis carried out by psychologists, for example, in the field of learning. A

decade later, Mason and Lott (1976) refer to a “new synthesis” and emphasize the common field of these related disciplines.

From these considerations biological studies in behavior are consolidated in a more solid discipline that goes beyond a mere description of causal-type explanations of behavior.

Though behavioral studies within the ethologic tradition must start with an observation period and the detailed recording of behavioral patterns, to be followed by the elaboration of an ethogram (recording of all the behaviors pertaining to a certain species), this procedure is not enough to explain behavior. Therefore, studies must be extended to be able to answer the basic inquiries associated with its immediate causes, development, phylogeny and biological function. Many of these investigations require experimentation in a laboratory with a strict control of variables and at a distance from the natural environment. On the other hand, more specialists in comparative psychology start to accept the study of the causes of behavior and evolution together with the naturalist approach of observation (Snowdon, 1983; Dewsbury, 1989).

This synthesis of biological studies of behavior has been quite productive and has extended mainly to the study of various bird and mammal species, in particular non-human primates. During the last quarter of the XX century, the studies worth mentioning are those of Jane Goodall in

chimpanzees (*Pan troglodytes*) at the Gombe Reserve in Tanzania (Goodall, 1986); the work of the tragically deceased Dian Fossey in gorillas (*Gorilla gorilla*) at the Karisoke Research Center in Ruanda (Fossey, 1983) and the research of B.M.F. Galdikas in orangutans (*Pongo pygmaeus*) at the Tanjung Puting Reserve in Borneo (Galdikas, 1984). Currently, few are the non-human primate species lacking some type of ethological study (Smuts et al., 1986).

ETHOLOGY OF THE HUMAN SPECIES

The early descriptions of an ethological type on the behavior of *Homo sapiens sapiens* are carried out by Darwin and published in his article *Biographical Sketch of a Boy* mentioned previously. Subsequently, in his *Study of Instinct*, Tinbergen addresses in only seven pages his ethological findings on man and states that human ethology is still in its infancy (Tinbergen, 1951).

Though human ethology has its sources in the studies of Konrad Lorenz, Niko Tinbergen and even Darwin, it is undeniable that its growth and posterior development are due to the efforts of Irenäus Eibl-Eibesfeldt, founder in 1975 of the Institute of Behavioral Physiology and Human Ethology of the Max-Planck Society in Andechs, Germany, and later appointed its director. At the beginning of the 60's, Eibl-Eibesfeldt, Austrian biologist and disciple of Lorenz, starts his research on human behavior from an ethological perspective. In

1961, he is invited by Eckhard Hess, former disciple of Lorenz as well, to the Department of Psychology in Chicago University as assistant; he then spends in 1966 some time at the Institute of Child Development in the University of Minnesota. In a lecture delivered in this institution (Eibl-Eibesfeldt, 1967), he propounds that the concepts of fixed-action pattern, innate unchaining mechanism, unchaining stimulus, spontaneity and playing, useful for ethologists, are relevant for researchers studying human behavior.

Eibl-Eibesfeldt proposes to the Max Planck Society a research program on transcultural documentation of human behavior. His proposal is accepted and in 1970 a research group is formed. This will be the seedling from which the current Research Institute of Human Ethology originates; this research center is still located in Andechs, Germany.

An interest in human ethology spreads rapidly to other areas of Europe and the United States. In the latter, in 1972, two books on the theme are published: *Ethological Studies of Child Behavior* (Blurton Jones, 1972) and *An Ethological Study of Children* (McGrew, 1971). Concurrently, a group of researchers from various disciplines creates the International Society for the Study of Human Ethology.

Human ethology, defined by Irenäus Eibl-Eibesfeldt as the “biology of human behavior”, is a discipline which has as object of study the behavior of the human species (*H.*

sapiens sapiens) by using the traditional methodology of biological sciences. Its basic reference framework is the Neo-Darwinian theory of evolution and its emphasis lies in the modal behavior of humans.

The biological study of human behavior faces a series of difficulties, practical and theoretical, that are not that important in ethological studies of other species. With regard to the practical aspect, for example, there are limitations in behavioral observations without disturbing the individuals participating in the study. On the theoretical side, the relation between the biological and cultural aspects with respect to the source of a given behavior is one of its more controversial issues.

The group of Eibl-Eibesfeldt, which makes an emphasis on undisturbed observations and the register of human behaviors of various cultures, especially traditional ones in the different continents, films more than 275 km of 16 mm cinema tapes that give rise to around 200 documentaries, with the aim of identifying universal characteristics of human behavior. A summary of these findings is published in *Human Ethology* (1989).

This search of universality has been successful. Some expressive motor patterns when statistically compared show constancy in form; its variability range is found to be similar in the various cultures studied. This is the case of the brow flash that fulfills the same role in those cultures. It can be stated that a uni-

versal grammar of social behavior exists, as manifested in diverse human cultures as a result of phylogenetic adaptations.

The research on phylogenetic inheritance, that has programmed aspects of our behavior and has limited our perception, lies a long way ahead and is yet to be perused. The study of human behavior with an evolutionist point view is drawing the attention of specialists from other disciplines of human behavior: psychologists, psychiatrists, anthropologists, sociologists, just to mention a few, grouped in the International Society for Human Ethology (ISHE). This organization produces an international bulletin called *Human Ethology Newsletter* that has become a relevant document in which a fruitful exchange of ideas on the subject takes place. In addition, two journals—*Evolution and Human Behavior* (formerly *Ethology and Sociobiology*) and *Human Nature*—assemble most of the empirical studies related to this area.

The last decade of human ethology has been enriched with the development of two research lines on cultural ethology denominated ethology of art and urban ethology. The first research line studies aspects related to phylogenetic adaptations in the realm of perception and determine our aesthetical sense and its role to communicate. The second line is initiated with the creation in Vienna of the Institute of Urban Ethology Ludwig Boltzmann. This institution is initially dedicated to the study of the

design of public places and their relation to the behavior of individuals using these places (Eibl-Eibesfeldt, 1997). Besides, new techniques to register and analyze non-verbal human communication are being developed (Grammer *et al.*, 2002; Grammer *et al.*, 2004).

The biological understanding of our species, particularly its evolutionary history, identification of modal patterns of behavior, their development and modeling by culture constitute a special point of interest for contemporary psychology and psychiatry.

REFERENCES

- Blurton, Jones N. (1972). *Ethological studies of child behavior*. New York: Cambridge University Press.
- Craig, W. (1918). Appetites and aversions as constituents of instincts. *Biol Bull* 34: 91-107.
- Darwin, C. (1873). *Expression of the Emotions in Man and Animals*. New York: D. Appleton & Co.
- Darwin, C. (1983). Apunte biográfico de un niño. En C. Darwin, *Ensayo sobre el Instinto*. Madrid: Ed. Tecnos, 83-99.
- Dewsbury, D.A. (1989). Comparative Psychology, Ethology, and Animal Behavior. *Ann Rev Psychol* 40: 581-602.
- Eibl-Eibesfeldt, I. (1967). Concepts of ethology and their significance in the study of human behavior. In H. Stevenson, E.H. Hess, H. Rheingold (eds.), *Early Behavior: Comparative and Developmental Approaches*. New York: John Wiley.
- Eibl-Eibesfeldt, I. (1989). *Human ethology*. New York: Aldine de Gruyter.
- Eibl-Eibesfeldt, I. (1997). *Human ethology*. Origins and Prospects of a New Discipline. In A. Schmitt, K. Atzwanger, K. Grammer, K. Schäfer (eds.), *New Aspects of Human Ethology*. New York: Plenum Press.

- Eliano, C. (1989). *Historia de los animales*. Madrid: Ediciones Akal.
- Fossey, D. (1983). *Gorillas in the mist*. Boston: Houghton Mifflin.
- Galdikas, B.M.F. (1984). Adult female sociality among wild orangutans at Tanjung Putting Reserve. In MF Small (ed.), *Female primates: studies by women primatologists*. New York: Alan R. Liss.
- Geoffroy-Saint-Hilaire, I. (1854-1862). *Histoire Naturelle Générale*, 3 vols. Paris: Masson.
- Goodall, J (1986). *The chimpanzees of gombe. patterns of behavior*. Cambridge, Mass: The Belknap Press of Harvard University Press.
- Grammer, K.; Fink, B.; Renninger, L.A. (2002). Dynamic Systems and inferential information processing in human communication. *Neuroendocrinology Letters*, 23 (suppl. 4):15-22.
- Grammer, K.; Fink, B.; Oberzaucher, E.; Atzmüller, M.; Blantar, I.; Mitteroecker, P. (2004). The representation of self reported affect in body posture and body posture simulation. *Coll Antropol*, 28 (suppl. 2):159-173.
- Haeckel, E. (1898). *Natürliche Schöpfungsgeschichte*. Berlin: Reimer.
- Hinde, R.A. (1966). *Animal Behaviour. A synthesis of Ethology and Comparative Psychology*. McGraw-Hill.
- Jaynes, J. (1969). The historical origins of "ethology" and "comparative pshychology". *Animal Behaviour*, 17: 601-606.
- Lorenz, K.Z. (1974). Analogy as a source of knowledge. *Science*, 185:229-234.
- Lorenz, K.Z. (1993). *La ciencia natural del hombre. "El manuscrito de Rusia"*. Barcelona: Ed. Tusquets.
- Mason, W.A.; Lott, D.F. (1976). Ethology and comparative psychology. *Ann. Rev Psychol* 27: 129-54.
- McGrew, W.C. (1972). *An Ethological Study of Children's Behavior*. New York: Academic Press.
- Mill, J.S. (1843). Psychology and ethology, Ch. III in *A System of Logic*. Reprinted in W. Dennis, *Readings in the History of Psychology* (1948). New York: Appleton-Century-Crofts.
- Schmitt, A.; Atzwanger, K.; Grammer, K.; Schäfer, K. (1997). *New aspects of human ethology*. New York and London: Plenum Press.
- Smuts B.B., et al. (1986) *Primate societies*. Chicago, IL: University of Chicago Press.
- Snowdon, C.T. (1983). Ethology, comparative psychology, and animal behavior. *Ann Rev Psychol* 34: 63-94.
- Taton, R. (1957). *La Science Antique et Médiévale. Des-origins a 1450*. Paris: Presses Universitaires de France.
- Thorpe, W.H. (1982). *Breve historia de la etología*. Madrid: Alianza Editorial.
- Tinbergen, N. (1951). *The study of instinct*. London: Oxford University Press.
- Wheeler, W.M. (1923). *Social life among the insects*. New York: Harcourt, Brace.
- Whitman, C.O. (1919). The behavior of pigeons. *Carnegie Inst. of Wash. Pub.* 257:1-161.

Fecha de envío: Agosto 24 de 2007

Fecha de aceptación: Agosto 31 de 2007