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Editorial note. Up until today, no one thought that many animals, especially vertebrates, have something more in common with man, namely, individual proper names. The following paper of H. HEDIGER, the founder of the Biology of Zoological Gardens, shows a first step in this new field of the behavioral sciences; still this preliminary presentation offers an opportunity to look at the animal as a carrier of a name in intra- and interspecific communication from a new viewpoint.

Proper Names in the Animal Kingdom

by H. HEDIGER[1]

CH–8603 Schwerzenbach, Gfennstrasse 29 (Switzerland).

Summary. For more than half a century, especially since the discovery of social rank order and territory in the animal kingdom, the assumption so to speak is in the air, and these two phenomenons in fact, have it as a supposition that many higher animals – from fish to mammal – may know each other individually and therefore carry unnamed names of acoustical, optical, odorous, and other nature. Nevertheless the idea of the name has hardly yet been used in this context because of the anthropocentrically fixed conception of civilized man that a name has to be a spoken or a written one and thus has to carry acoustical or optical features.

But just as there are in animals and man a thinking without words and a counting without numbers (thus unnamed thinking and unnamed counting) as shown by OTTO KOEHLER, so there are also (again in animals and man) unnamed names, as paradoxical as this may sound. This individual name distinguishes each animal from each other within a natural group e.g. a social unit, a clan, a family, between neighbours etc. Whereas species-odor has long been known and even used sometimes in the zoological taxonomy (odor of the goats, civet, musk odor etc.) and for a long time man has worked with the nest-odor of social insects, the general acknowledgement of individual names in the animal kingdom is on the other hand still unusual.

The fact that for milleniums man has had the practice of giving personal acoustic names (call-names) to familiar animals of his suroundings is only possible based on the fact that such names in principle already exist (unnamed) in animals.

The animal which carries a proper name distinguishes itself from the other individuals by it and reacts only to it. Its proper name is part of its (animal) personality. Therefore it distinguishes between its own self and the non-self. Research on the occurrence of proper names in animals may also open a new door to the delicate problem of selfconsciousness in animals.

Since the decisive effort of KARL LINNÉ (1707–1778) to give each animal and each plant a genus name as a noun and a species name as an adjective and thus since the introduction of the binary nomenclature, the zoological sciences have made great efforts to extend and to improve the appropriate and necessary terminology. This, as well as in other points, can be seen in the ternary nomenclature. An international committee is in charge of the nomenclature; taxonomy is the essential basis of all scientific activity in biology; everyone needs to know which species and subspecies he is working with. Zoology – ethology included–remained so fascinated with this very important naming of the animals that the question of a taxonomy from the animals point of view and of naming by the animals themselves was scarcely asked. However, I have been preoccupied with this for many decades[2].

In 1965[3] I tried again to point out the importance of the taxonomy amongst animals: several predatory animals distinguish, e.g. different categories of prey by size, appearance, odor, etc. By no means do they attack indiscriminately what they perceive, but avoid dangerous or very unpleasant prey, at least after a first painful or unpleasant meeting, as for instance a porcupine or a skunk. There is also no doubt that many potential prey distinguish different kinds of predatory animals; under certain circumstances they use different warning signals or different flight-dis-

[1] Acknowledgment. I am very much indebted to R. KELLER and D. TURNER for the translation of the manuscript from German into English.

[2] H. HEDIGER, Mitt. naturf. Ges. Bern *1941*, p. 38–55.

[3] H. HEDIGER, *Tiergarten-Biologie* (Albert Müller Verlag, Rüschlikon 1965), p. 84.

tances and flight-reactions depend on whether it is, e.g. an enemy in the air or an enemy on the ground, a quick or a rather slow enemy. Towards a goshawk the hare behaves differently than when confronted with a fox or a magpie. The main characteristics of certain enemies may be innate to the prey; or it may receive its information by individual learning. For many animals of the polar regions, the Galapagos Islands, Mauritius or other regions where 'man' was not an enemy (Great Auk, Steller's Sea cow, Dodo, Sea-elephant), the consequences are known.

In my attempt to make a first preliminary analysis of the meaning of man for the animal, I mentioned five elementary categories: an enemy, a prey animal, a symbiont, a piece of the surrounding or a member of ones own species (with a certain place in the social rank-order). The assumption of the last mentioned meaning is that an animal not only incorporates a definite person into its own species but also in its particular social structure. This person is viewed and treated as an unexchangeable individual.

In reality the presumption of every social hierarchy is that in it, each member is recognized individually and thus distinguished clearly from the neighboring individual. By what is it distinguished? – by features which agree accordingly with the proper name.

For an animal psychologist it is extremely surprizing that since the discovery of the social hierarchy by SCHJELDERUP-EBBE[4] in the year 1921, thus for more than half a century, the surely obtruding consequences were not seen, namely, that – at least in higher animals – individual features, that means proper names, are a matter of fact.

Likewise it is surprizing that another fundamental discovery, namely territory, in the year 1920 by ELIOT HOWARD[5], also has the assumption that neighboring animals know each other individually and that for half a century nobody thought in principal that individual recognition must be based on names.

Man has given domestic animals names probably since they were first developed about 12,000 years ago (first the dog, and later other domesticants). This should have been another reason to think that perhaps animals themselves use proper names too.

One of the main reasons for neglecting the animals' own proper names until now was without a doubt that they cannot be named – in contrast to humans – from Christian or other religious sources (Johannes, Peter, Mohammed, etc.); rather from the unnamed, according to the nature of the animal. As paradoxical as this may be, animals have unnamed names (proper names). To understand this, it is necessary to refer to the classical experiments of OTTO KOEHLER[6–8] on unnamed thinking and on unnamed counting. He was able to show convincingly that thinking originally was not constrained to words, counting not to numbers. This is not only valid in (higher) animals, but even in the human infant[8]. This phenomenon, i.e. the prelingual state in the ontogeny of thinking in the infant, has since occupied several scientists (e.g. SCHOLICH[9]); it is also of particular interest for the animal psychologist who depends on this lingual one-way-system when communicating with animals.

A proper name need not necessarily be written or printed (illiterate, primitive races); rather it can be an acustical or an optical feature. Recognition, a communication with an individual is also possible by calling (vocally identifying oneself, calling for an identification) the name or by perceiving the face, another part of the body, or the way of walking, etc. Civilized man today has great difficulties to imagine that there can be also an odorous proper name; for mammals exactly these were the first cues. This is not surprizing: STARCK[10] points out correctly that all primitive Eutheria were originally macrosmatic animals, and that the regression of the olfactory apparatus was a very slow process.

That even for man, odor-names can have importance under certain circumstances, is shown by the investigations of EIBL-EIBESFELDT[11] of children deaf and blind born. They distinguish the persons in their surrounding by their individual odor of their hands.

It is well known that the macrosmatic dog with its highly capable sense of smelling, which exceeds the human one by a several thousandfold, has no trouble distinguishing men by their 'odor face'. The work on identification by smell of an appropriate trained police dog is based upon odor: identification object-man and man-object.

The very poor capacity of the human sense organs is surely partly responsible for consistent overlooking of the proper names in the animal kingdom. Today, this is no longer an intelligent viewpoint. Nevertheless it lasted until the knowledge of the territory displaced the naive idea of the 'golden freedom' or the understanding of social hierarchy with belief in personal freedom. In many respects the basic behavior of the animals is nearer to ours than we thought; so is the case for the proper names too. That animals know each other individually has been proven in the most different systematical groups (from fish to apes) in the last decades; but in this ability, none of the attributes of a proper name was seen.

[4] Th. SCHJELDERUP-EBBE, *Beiträge zur Biologie, Sozial- und Individualpsychologie bei Gallus domesticus* (Greifswald 1921).
[5] H. E. HOWARD, *Territory in Bird Life* (Cambridge Univ. Press, London 1920).
[6] O. KOEHLER, Proc. int. Ornith. Congr., Uppsala 1950, p. 383–392.
[7] O. KOEHLER, Verh. dt. zool. Ges., Freiburg *1954*, 203–211.
[8] O. KOEHLER, in *Kreatur Mensch* (H. Moos Verlag, München *1969*), p. 130, 131.
[9] B. SCHOLICH, in *Hominisation und Verhalten* (Eds. G. KURTH and I. EIBL; Fischer Verlag, Stuttgart *1975*), p. 266.
[10] D. STARCK, in *Hominisation und Verhalten* (Eds. G. KURTH and I. EIBL; Fischer Verlag, Stuttgart 1975), p. 211.
[11] I. EIBL-EIBESFELDT, in *Hominisation und Verhalten* (Eds. G. KURTH and I. EIBL; Fischer Verlag, Stuttgart 1975), p. 375.

Göz[12] deserves merit as he showed with accurate experiments, under the tutorship of his teacher KARL VON FRISCH, that several fishes not only have a species-odor, but also within the species have individual odors which with full authority we dare to describe as an odor-name. Fundamentally he states what future scientists later confirmed for different vertebrates: 'With the species-specifity of these odorous substances, the highest level of their differentiation however is not yet reached in the range of animal life. The members of one species are distinguishable by pecularities, which give these odors of each individual a personal impress' (p. 17). He also refers to the individual odors demonstrated by SCHMID[13] in dogs as early as 1935.

Later HERTER[14] called attention to the meaning of individual odors in the social behavior of many fishes in general; since then individual recognition, respectively odorous proper names, in fishes has been implied by many scientists, but never has been named as such. To mention one of the most recent papers in this field (with literature review), we may look to ZAYAN[15]. He found that Sword-tails (*Xiphophorus*) recognize each other individually.

The discovery of all major behavioral categories, e.g. the territory or the social hierarchy, were made on birds; thus here too we have the occurence of proper names. Surely MARLER[16] was one of the first with the help of exact recording and analyzing equipment to prove that the chaffinch not only has a species specific song, but also individual acoustic calls, which mean self-announcement or proper names (self-signalling name).

Nearly two decades later, together with LINDA HOBBETT[17], he showed the same in the chimpanzee. At the other end of the primate spectrum, WILLIAMS, SORENSON and THOMPSON[18] showed evidence of the proper name in tree shrews not only in the sense of the self-signalling name, but also of the callname, with spectrographical analyses of their antiphonal song. Characteristically this was discovered in the birds and has been thoroughly researched, especially by THORPE[19–21].

It is a long-known fact that some birds – apart from acoustical – also have optical proper names. This means that they can recognize a face personally. HEINROTH[22] said with respect to ducks, geese and swans, 'that all these animals know each other only by face which for us look all the same'.

The same is also true for many birds of prey, cranes, ravens, jackdaws and others (K. VON FRISCH[23]). In connection with his new research about individualism in bird songs, THORPE[24] pointed out that Montagu already in 1802 asserted that we can find acoustical names in birds too.

This duetting, or antiphonal singing, which to date has been proven for dozens of species occurs when one partner of a pair executes only one part of the song and the other partner strikes in and sings the second part – with such a precision that the observer believes that the whole song has been cited by just one individual. This antiphonism has been found especially in species which live in densely grown biotopes, i.e. those where after a short distance optical contact disappears. The first half of the verse has the character of a proper name, i.e. of an individual, self-signalling name as in the chaffinch; likewise, for the half of the verse sung by the other partner, this guarantees an acoustical contact over all optical hindrance. In all of the cases of antiphonal singing examined up until now both partners know the whole song, but usually cite only their part. But if the part of the partner is sung (imitated) it has the effect of a challenge to appear immediately; in other words, as a call-name.

THORPE[24] circumscribed inconfoundably the name-character of such calls without using the expression of name for it: he describes, with reference to the observations of BREMOND on the robin, that the imitated song of an intruder by the owner of a territory is a signal which accordingly means: 'I am talking to you, invader of the moment'. In one way, the proprietor has imitated the stranger calling him by name. Duetting, i.e. antiphonal singing, is related most closely with mocking, i.e. imitating, which has long since been known by the ornithologist, but insufficiently explained. Surely an original form, perhaps the archetype of imitating, is the imitation of the partner's song. That too brings us nearer to the understanding of the fact already mentioned by HEINROTH[22] that the popular imitators, namely the parrots, never imitate in the field, but let us hear only their specific screaming. These sound productions, heard by the human ear only as screaming, are in reality antiphonal songs, which, as subdivided verses of the song, serve localization and communication between partners.

[12] H. Göz, Z. vergl. Physiol. *29*, 1–45 (1941).
[13] B. SCHMID, Z. vergl. Physiol. *22*, 524 (1935).
[14] K. HERTER, *Fischdressuren und ihre sinnesphysiologischen Grundlagen* (Akademie Verlag, Berlin 1953), p. 78.
[15] R. C. ZAYAN, Behaviour *52*, 266–312 (1975).
[16] P. MARLER, Ibis *98*, 213–261 (1956).
[17] P. MARLER and L. HOBBETT, Z. Tierpsych. *38*, 97–109 (1975).
[18] H. W. WILLIAMS, M. W. SORENSON and P. THOMPSON, Folia primat. *11*, 200–205 (1969).
[19] W. H. THORPE, *Bird-Song* (Cambridge University Press, Cambridge 1961).
[20] W. H. THORPE and M. E. W. NORTH, Nature, Lond. *208*, 219–222 (1965).
[21] W. H. THORPE, in *Brain Mechanism Underlying Speech and Language* (Grune & Stratton, New York 1967).
[22] O. HEINROTH, *Aus dem Leben der Vögel* (Springer, Berlin 1938), p. 63.
[23] K. VON FRISCH, *Biologie* (Bayrischer Schulbuch-Verlag, München 1967), p. 241.
[24] W. H. THORPE, in *Non-Verbal Communication* (Ed. R. HINDE; Cambridge University Press, Cambridge 1972), p. 153.

These parts of the song, or these proper names, are usually biological sounds that are added to the innate part of the song (if present) through individual learning. Through individual learning a strange sound can be built into the proper name (self-signalling name and call-name) in some species, e.g. in the raven, the australian lyre-bird and others. Most obviously KOEHLER[8] (p. 131) demonstrated this fact: 'Gwinner's male raven barked like a dog; his female imitated the gobbling of a turkey. When the male escaped, the female barked; as the female was brought at a distance to the male-known cage, he gobbled from the corner of his container which had a view to her cage. Instead of the personal feature of the first innate call, the personally learned strange sound becomes the proper name with which one speaks to each other'. Therefore this citation of KOEHLER has a special meaning because it contains for the first time the word and the idea of 'proper names' in connection with animals – and that – with untrained animals; characteristically they were birds again, which as mentioned before, always have priority.

The second time I found the word 'name' in the sense of proper names was in an article of HOOKER and HOOKER[25]; that, too, was in connection with the observations of GWINNER and KNEUTGEN[26] with *Corvus corax* and *Copsychus malabaricus*, referred to by KOEHLER: 'If the male was absent the partner would use sounds normally reserved to the absent bird, with the result that the male would return, as if called by name'. The word proper name (propri nomi) for animals was probably first used by SEBEOK[27].

In trained animals, which are characterized by a closer intimacy to man, the existence or the effect of (acoustic) proper names is common-place knowledge (zoo, circus); but until now, this rarely received any scientific attention or acknowledgement, even though each domestic dog, each horse, gets its proper name and reacts correspondingly.

For a long time, the discovery of the proper name was left floating in the air. Until now, proper names have been circumscribed in the sciences of behavior, particularly in the objective one, i.e. in ethology, by the less subjective characterization as 'individual recognition'. Everywhere in practice where one needs to work with a certain individual of a group of animals, e.g. in a zoo, a circus, or recently, in scientific research in the field with game animals, the observer tries to give the individual features a most (meaningful), impressive, most characteristical name, corresponding to human habits.

J. VAN LAWICK-GOODALL[28] should be mentioned as an especially impressive example. She gave such names to free-living chimpanzees with which she lived for years. A list (p. 111f) contains over 80 names which go from HUXLEY to VODKA. Fundamentally, this is a question of making one's work easier by translating the proper names which for human beings are so difficult to recognize and even more difficult to use as they occur in chimpanzees in a natural way. (MARLER and HOBBETT[17].)

By the way, this attests to the quality of the observations. Several field scientists make themselves the translation of animal proper names for practical use quite easily: They narcotize their animals with a capture gun and adhere to them very coarse optical names, e.g. broad colored collars; this, without a thought about what they do with that kind of deformation to such animals which already carry optical proper names, e.g. the zebras, the giraffes. Their proper names quite easily can be distinguished by their individual marks. The equivalent is true for other game animals. PETERSEN[29] suggests a nomenclature for the markings of the stripes of the steppe zebras that makes identification easier. After KLINGEL[30] (p. 73), the zebras not only have their optical names but their recognition is also based on acoustical and odorous features.

Already in 1907 PFUNGST[31] showed that the domestic horse reacts very sensitively to optical signals (movements of less than 1 mm). There is obviously a connection between this extremely fine optical perceptive ability and the immediate recognition of individual features in the stripes of members of one's own species (optical proper names).

As for our consideration of the occurence of proper names in the animal kingdom, the thesis of RENSCH[32] is of special interest: this shows that domesticated animals are capable of learning proper names given by man. In view of his enormous experience with Indian working elephants (RENSCH and ALTEVOGT[33]), which in fact are not domesticated, but tamed and trained wild animals, it is quite surprizing that the existence of proper names in wild animals did not occur to him. As mentioned earlier, in the zoo – and all the more in the circus – the occurrence and the use of proper names is a matter of course, indeed an assumption for each qualified work. But for a longer time, zoo and circus research have been scientifically taboo (HEDIGER[34]).

[25] T. HOOKER and B. I. HOOKER, in *Bird Vocalizations* (Ed. R. A. HINDE; Cambridge University Press, Cambridge 1969), p. 203.
[26] E. GWINNER and J. KNEUTGEN, Z. Tierpsychol. *19*, 692–696 (1962).
[27] Th. A. SEBEOK, Quad. Studi semiot. *1975*, p. 19.
[28] J. VAN LAWICK-GOODALL, in *Hominisation und Verhalten* (Eds. G. KURTH and I. EIBL; Fischer Verlag, Stuttgart 1975).
[29] J. C. B. PETERSEN, E. Afr. Wildl. J. *10*, 59–63 (1972).
[30] H. KLINGEL, Verh. dt. zool. Ges. *1975*, 71–80.
[31] O. PFUNGST, *Das Pferd des Herrn von Osten* (J. A. Barth, Leipzig 1907), p. 92.
[32] B. RENSCH, in *Studies in the Philosophy of Biology* (Eds. F. I. AYALA and DOBZHANSKY; McMilton Press, London 1974), p. 253.
[33] B. RENSCH and R. ALTEVOGT, Z. Tierpsychol. *11*, 497–510 (1954).
[34] H. HEDIGER, *Tierpsychologie im Zoo und im Zirkus* (F. Reinhardt Verlag, Basel 1961).

In the laboratory, one mainly or exclusively works with anonymous animals, with invertebrates (e.g. *Drosophila*), which lay outside the natural occurrence of proper names; or perhaps one works with mice and rats, which, at best, are found in a transition zone.

The question of the taxanomical position of potential carriers of proper names is a most exciting one, but one, which has to be reserved for a later publication. Here only a paper by ERNA MOHR[35] will be mentioned; her research rooms had on one side a museum and on the other side a zoo. MOHR had the habit of teaching her long kept animals individual call-names; but with the bank vole (*Evotomys glareolus*) she had no success. 'Both were too stupid to get accustomed to a call-name; such a name makes work with animals so much easier that always I first tried with it. It has its advantages, on the one hand, when a called animal looks, comes and does what it should do, and on the other hand, when an animal ignores all calls which are not for it personally – no matter whether they are elephants and lions or mice and rats. It seems to me that in mice intelligence increases with the length of the tail. The dumbest are the field vole and the common vole, and the bank vole is not much better; next comes the vole rat which can be accustomed to a call-name. The following is an ascending row striped field mouse, house mouse and eastern house mouse, wood mouse, (I could not yet keep the brown rat, so I do not have any possibility to compare) then the house rat. There is only one exception, the harvest mouse which at the most can be put at the same level as the red-backed vole, perhaps not even that'.

Disregarding the strangeness which is expressed in this quotation of the brilliant mammalogist, this passage contains two very important hints for our theme. First the importance of naming the elephants and lions, i.e. in animals of the circus, is emphasized; this has been mentioned before. Second – in principle – the relation between the occurrence of proper names and the taxonomical grouping is shown presumably for the first time.

As in the use of tools, in lying, in the ability to remember etc., the occurrence of proper names cannot simply be connected with the place in the zoological system; rather the occurrence of proper names is desultory. Nevertheless it can be said that within the vertebrates, it can be found in representatives of all orders. But doubtless, it can also be found in many invertebrates. Here, though, it is solely a question of the fundamentals.

It should still be mentioned that PILLERI, GIHR, KRAUS and BERNATH[36] (p. 14) have observed in an intelligent rodent, the beaver (*Castor canadensis*), that one tame individual always reacted to calling the name 'Beavs'; it came out of the den and greated the familiar persons which could be demonstrated photographically and sonographically.

In accordance with STEINIGER[37], LORENZ (1963, 24) assumes that brown rats within the same group do not know each other individually, and therefore cannot have any proper names. For this reason, he chose the social order of the brown rats as a typical example of the so called 'anonymous group'. Rats have only a clan name (odorous), according to him.

That brings us to a short consideration of the different categories of names which are found in human society as well as, in principle, in the zoological taxonomy made by man. Strangely, the collective (odorous) clan, or family name, was discovered long before the individual proper name: the hive-odor of bees or the nest-odor of ants has long been well known, as well the fact that individuals with a strange family name (family odor) are treated as an enemy. This is a phenomenon that has many similarities to the current topic, xenophobia (HOLLOWAY[38]).

For example, in the Australian sugar gliders, SCHULTZE-WESTRUM[39] showed that the individuals – contrary to rats – recognize each other by the odor, i.e. by the odoros proper name. That should be true for most of the macrosmatic mammals, especially for those which scent-mark their territory. SCHALLER[40] who observed the lions of the Serengeti during 3 years, thinks it is possible that each pride of lions has its specific odor, in the same sense as described by SCHULTZE-WESTRUM[39] for the sugar glider. The specific odor would serve to keep the group together and the very often observed head-rubbing between lions could help to spread the odor of the pride. Beyond that, SCHALLER thinks it possible 'that lions can recognize each other by odor, but whether they do so individually or by a group smell or by both is not clear'. Naturally it is not possible to prove this in field research; but there could also exist an individual smell – an odor-name – in the lion, analogous to the dog and the sugar-glider where it has been proven experimentally.

Scent marking of the territory has – as well as the acoustical – its real sense in its individual components. That is in full accordance with the most recently and now frequently described fact that the inhabitants of neighboring territories show a certain tolerance to each other; to some extent, friendly neighbor relations can even develop, especially in such species which permanently occupy the same territory under certain circumstances for years. This occurs, e.g. in a lot of carnivores, antilopes, rhinos, etc.

[35] E. MOHR, Z. Säugetier-Kd. *4*, 49–54 (1929).
[36] G. PILLERI, M. GIHR, C. KRAUS and O. BERNATH, Revue suisse Zool. *82*, 13–26 (1975).
[37] F. STEINIGER, *Rattenbiologie und Rattenbekämpfung* (F. Enke Verlag, Stuttgart 1952).
[38] R. HOLLOWAY, *Primate Agression, Territoriality and Xenophobia* (Academic Press, New York 1974).
[39] Th. SCHULTZE-WESTRUM, Z. vergl. Physiol. *50*, 151-220 (1965).
[40] G. B. SCHALLER, *The Serengeti Lion* (University of Chicago Press, Chicago 1972), p. 88 and 92.

Not every conspecific individual has to reckon with threat and fight when it moves into the territory of a neighbor. It even is possible that there are real 'visits' as NEAL[41] described probably for the first time in the badger. It is possible that such friendly neighbor relations sometimes are based on kinship. Future experiments will clear this up.

The fact that not every crossing of the territorial border leads to threatening and fighting, thus, that apart from territorial defense a territorial tolerance can exist, may explain several, current, apparent contradictions. For example, some authors do not agree whether the African rhinos are territorial or not. Authors which dispute the territoriality of *Diceros* and *Ceratotherium* cite the fact that supposed borders often are crossed, that even the same dung-hills are used. The same is mentioned also of the apes, e.g. the gorilla and the chimpanzee; by this, a certain non-regarding of the borders is meant, the overlapping of home ranges. Without any doubt, in a lot of cases this can be explained by the mentioned tolerance between well known, i.e. namely known (partly too even related) neighbors. As mentioned earlier, MARLER and HOBBETT[17] showed that chimpanzees recognize each other individually by their calls.

Violent, combative defense of a territory is released in the first place by unknown, in the proper sense, strange individuals (and these are always eerie). This has been shown for example by implanting strange rhesus monkeys in existing territorial groups which has been done by SOUTHWICK et al.[42] in India.

The behavior of long-intimate territory neighbors was also excellently characterized and proven by filming by RITTINGHAUS[43] in the example of the oyster-catcher (*Haematopus ostrelagus*): 'There is no doubt after the experiences with personally known oyster-catchers of my population on the island of Oldeoog that not only the respective partner but also the neighbors of the last year recognize each other during the occupation of their old territories. Mostly, they are intimate to each other already after a few days; indeed, they still threaten occasionally. But, on the whole, they respect the borders of the territories of the others and start very soon to collectively drive away strange intruders'.

FALLS[44] observed that territorial birds reacted much more strongly against strange individuals than against their intimate neighbors. He could show this experimentally with the help of replaying different songs. I, myself, have the strong suspicion that the songs of trios described by THORPE[20] (p. 222), e.g. of *Laniarius aethiopicus*, *Cossipha heuglini*, and others, which could not be understood by him, signify a report of presence of good neighbors in the same way that long-acquainted gazelle bucks mark within the territory of the neighbor with their secretion from the antorbital organ, or rhinos leave their odor tracks on neighboring dung-hills.

The following may hold as a rule: the 'pedantic' and serious combative defense of a territory is not so much directed toward old acquaintances, intimate neighbors, but essentially against really strange members of the own species which is what is meant basically by the expression xenophobia (HOLLOWAY[38]).

Often the idea of the territory has been misunderstood, namely as a well-circumscribed area that under no circumstances other members of the species are allowed to enter without risking a life-and-death-struggle. In fact, this type of territory and the appropriate behavior are found, but one should not forget that the territories of the various species can be as different as their chromosomes or their morphological appearances. Not only can a remarkable tolerance exist for intimate, territorial neighbors, i.e. known by name, but – as in the case mentioned above of the oyster-catcher – this may lead to assistance in the case of intrusions of really strange individuals.

The tolerance of territory neighbors has been described excellently by WALTHER[45] with the example of the well researched Thomson's gazelle (*Gazella thomsoni*). In the Serengeti he found 65 marked halms in an area of 1000 m^2 out of the territory of one Thomson's gazelle buck; I again found them myself in 1976 also. With the secretion of the antorbital organ, the territorial male makes a nearly circular marked area in zig-zag-lines in which the density of the marks increases toward the centre (gradient of concentration). At the border, nonterritorial males sometimes mark too, but the concentration of the marks of a certain individual (odorous name) tells the members of the same species not to intrude any further. Out of this arises the possibility of making one's own presence known to the neighbors, similarly as it is e.g. in the rhinos.

Often symbolic expositions occur between intimate neighbors, i.e. neighbors known by name, among gazelles, gnous and others which have more the character of a pastime than of a serious fight. WALTHER[46] (p. 877) talks of friendly neighbor relations between territorial Thomson's gazelles and of 'genial' rubbing of the horns (Stirnlehnen) as the lowest level of the strength of combat between neighboring males.

Tolerant, respectively friendly neighbor relations between personal, i.e. by name, acquaintances have

[41] E. NEAL, *The Badger* (Collins, London 1948), p. 36.
[42] Ch. H. SOUTHWICK, M. Y. FAROOQUI, M. F. SIDDIQI and B. C. PAL, in *Primate Aggression, Territoriality and Xenophobia* (Ed. R. H. HOLLOWAY; Academic Press, New York 1975), p. 185–209.
[43] H. RITTINGHAUS, *Encyclopedia cinematographica* (Inst. f. wissenschaftlichen Film, Göttingen 1964), p. 5.
[44] J. B. FALLS, *Bird Vocalizations* (Ed. R. A. HINDE; Cambridge University Press, Cambridge 1969), p. 219.
[45] F. WALTHER, *Neue Brehm Bücherei* (A. Ziemsen Verlag, Wittenberg Lutherstadt 1968), p. 40.
[46] F. WALTHER, Z. Tierpsychol. *21*, 871–890 (1964).

been observed lately in a lot of other species. WICKLER[47] talks of the peacefulness toward the neighboring people, e.g. in primates: 'Neighboring groups of baboons are amazingly peaceful when they meet each other; but if one brings individuals far away to other groups they will be killed'. ANGST and KUMMER[48] confirm that all individuals, older than infants, of a group of baboons know each other personally and maintain between each other richly-structured relations. Moreover, one has to consider that such groups consist in general of 30 to 85 animals. Perhaps even more distinctly, VOGEL[49] circumscribes the nature of the name – without using this word – by the characterization of primate societies as a narrowly interweaved web of personal relations and bindings. 'Each member of the group knows its relation and position to each other member of the group'. WICKLER[47] (p. 484) points out that many animals show quite definitely through their behavior that they can distinguish certain members of their own species from all the others, as say, the birds mentioned before. 'This is most clear in constant groups of wandering animals with a social order. If animals stay at one place, one can seldom decide immediately if they really recognize stronger members of their species or only the place from which they regularly are chased away (by a member of their own species). Many animals living in closed groups know actually all group members individually'. This fact, which is commonly accepted today, can in our context be translated to mean that they known each other by name whether these names are of acoustical, optical or odorous nature.

TURNER, SHAUGHNESSY and GOULD[50] in a recent paper state very clearly: 'Individual recognition is ultimately based on some form of communication; visual, olfactory, auditory, tactile and/or gustatory stimuli provide the cues for identification. Animals tend to emphasize one avenue of communication more than others, and the kinds of stimuli utilized depend on the habitat and mode of life of the species'. The authors found in the bat *Myotis lucifugus* that individual recognition between mothers and infants did occur based on auditory and/or olfactory stimuli. They also found antiphonal chirps in this species and they give a valuable list of references. In another paper, GOULD, WOOLF and TURNER[51] point out that in different bat species the mother's routine of foraging for food each night and returning to the roost to nurse her infants requires many reunions with the infants in the midst of scores, hundreds or even thousands of bats in a nursery colony. The pervasiveness of double-notes in the vocal repertoire of mother and infant bats in distantly related taxa and the obvious requirement for efficient communication to ensure reunion of mother and infant suggest that the signal may be an important type of vocalization in bat behavior. Although according to the authors, a definite proof that individual recognition is facilitated by ultrasonics is still wanting, the existence of ultrasonic names in bats seems to be very probable to the writer of this article.

TSCHANZ[52] has shown that guillemots (*Uria aalge*) already as embryos, i.e. in the egg, learn the individual voices of their parents, or in other words, their names. Interestingly, TSCHANZ[52] (p. 88) has also taught young guillemots normal human names such as Cäcilia, Kasimir, Irene, Daniel etc. by the help of loudspeakers.

The ease with which acoustical names can leap over optical ones is shown, e.g. in human groups during situations in which for some reason calling is not allowed. One beckons someone to come here, but it is not exactly clear which person is meant. The one coming most into question will then ask by putting his forefinger on himself, usually on his chest. Indeed, this gesture is no lasting name; however, it shows how easily a call-name can be translated by a gesture and how with both signals an identification of one's own self is connected. This is an entirely essential peculiarity of each proper name, a knowledge of one's own self that has a very close relation to a primitive knowledge of 'self', i.e. we are considering a significant primitive form of (human) selfconsciousness with which we will be concerned.

First in brief, the translation of acoustical and optical names will be mentioned once again, because it has been used lately by several authors (GARDNER, PREMACK, FOUTS) working with chimpanzees in connection with teaching the American sign language to the remarkably untalented (acoustic lingually) apes. THORPE[21] (p. 8) has stated that 'apart from man, birds are incomparably better imitators than any other living beings'. FOUTS[53] taught his chimpanzee Lucy a sign for her name that she used in the correct way, e.g. when she wanted to be tickled. When she signalled 'tickle Lucy', she already prepared herself for the pleasant work. But when presented the signal 'Lucy tickle', she immediately started to tickle ROGER FOUTS. The three-word-combinations 'Roger tickle Lucy' and 'Lucy tickle Roger' also had the corresponding success.

PREMACK and PREMACK[54] also reached the point where, with their nonverbal communication method, in which the meanings of words were translated to colored plastic figures, their chimpanzee, Sarah, soon

[47] W. WICKLER, in Evolution der Organismen (Ed. A. G. HEBERER; G. Fischer Verlag, Stuttgart 1967), p. 485.
[48] W. ANGST and H. KUMMER, in *Hominisation und Verhalten* (Eds. G. KURTH and I. EIBL; G. Fischer Verlag, Stuttgart 1975), p. 58.
[49] Ch. VOGEL, in *Holminisation und Verhalten* (Eds. G. KURTH and I. EIBL; G. Fischer Verlag, Stuttgart 1975), p. 22.
[50] D. TURNER, A. SHAUGHNESSY and E. GOULD, in *Animal Orientation and Navigation*, a Symposium (Ed. S. R. GALLER; NASA, Washington DC 1972), p. 000.
[51] E. GOULD, N. K. WOLF and D. C. TURNER, J. Mammal. *54*, 4 (1973).
[52] B. TSCHANZ, *Trottellummen*. Z. Tierpsychol. 1968, Beilage 4.
[53] R. S. FOUTS, in *Hominisation und Verhalten* (Eds. G. KURTH and I. EIBL; G. Fischer Verlag, Stuttgart 1975), p. 145.
[54] A. J. PREMACK and D. PREMACK, Scient. Am. *227*, 92–99 (1972).

learned her optical proper name as well as the names of their attendants and other chimpanzees. All carried too their names in form of a plastic figure on a collar. By correctly arranging the plastic figures on a magnetic blackboard, Sarah could write, e.g.: 'Give apple Sarah'. Once – and never again – Sarah wrote the sentence 'Give apple Gursie'. Thereupon, her teacher immediately gave the apple to another chimpanzee named Gursie. Also in other captive chimpanzees, they could be brought so far that they adopted an artificial signal as a proper name and used it in the right way. They definitely identified themselves with it which belongs to the character of each true proper name. By this, they manifest a knowledge of one's own self in the above-mentioned sense.

Another way to prove the knowledge of one's own self, the identification of 'self', will also be mentioned because it – with others – shows that the animal self-consciousness, respectively its preformed nature has to remain closed by no means as many scientists think, and as AUTRUM[55] has formulated clearly: 'Consciousness and personality in animals are for us absolutely inaccessible phenomena'.

GALLUP[56] accustomed chimpanzees during a longer period to mirrors, then narcotized them for a short time and spotted them with fast drying red color at places of the body (e.g. above the eyebrows, tips of the ears) they themselves could not see. Not until the next look in the mirror could they discover the unaccustomed marks on themselves and investigate them with the fingers. Here as well, a definite identification, a recognition of one's own self, has taken place. This by no means says that strongly, optically-orientated animals always see a strange rival in the mirror that they try to combat. GALLUP could observe this recognition of one's own self in front of the mirror in chimpanzees, but not in Macaques (*Macaca fascicularis* and *Macaca irus*).

In fact, each imitation, as we find them in so many birds, namely in all birds that mock, needs a certain (primitive) consciousness as an assumption (THORPE[19], p. 78), in so far that within it a knowledge of one's own self is expressed and a knowledge of the other one being imitated. I presume that the highest level of such imitation is found in the little-investigated (scientifically) Australian lyre-bird (*Menura*) that usually imitates about 20 other bird species (SMITH[57]) as well as human voices, barking of dogs, technical noises and so on.

PORTMANN[58] concludes that there is a conscious hearing and therefore an animal self-consciousness from the extraordinary performance of imitation in Menura. – KOEHLER[59], RENSCH[32] (p. 252), DOBZHANSKY (cited in RENSCH[32]), SEIFERLE[60] and many others are of the opinion today that the animal consciousness must not remain totally closed.

[55] H. AUTRUM, *Biologie – Entdeckung einer Ordnung* (Deutscher Taschenbuch-Verlag, München 1975), p. 111.
[56] G. G. GALLUP, Science *167*, 86 (1970).
[57] L. H. SMITH, Natn. geogr. Mag. *107*, 849–857 (1955).
[58] A. PORTMANN, *Das Tier als soziales Wesen* (Rhein-Verlag, Zürich 1953), p. 350.
[59] O. KOEHLER, Verh. dt. zool. Ges. *1954*, 332. – O. KOEHLER, Proc. 14. Int. Congr. Zoology, Copenhagen 1953.
[60] E. SEIFERLE, *Lehrbuch der Anatomie der Haustiere* (Parey, Berlin, Hamburg 1975), Bd. 4.

SPECIALIA

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Diterpene Acids as Larval Growth Inhibitors

C. A. ELLIGER, D. F. ZINKEL[1], B. G. CHAN and A. C. WAISS JR.[2]

Western Regional Research Laboratory, Agricultural Research Service, U. S. Department of Agriculture, Berkeley (California 94710, USA), 20 April 1976.

Summary. Kaurenoic and trachylobanoic acids from sunflower inhibited larval development in several Lepidoptera species. The tricyclic resin acids were also effective in curtailing growth of *Pectinophora gossypiella* and either reduction to carbinol or esterification of the carboxyl group lowered activity. Partial reversal of growth inhibition in the presence of relatively large amounts of cholesterol suggests an interaction with the insects' hormonal system.

A recent study[3] on the nature of resistance in sunflower (*Helianthus annuus* L.) to attack by larvae of the sunflower moth (*Homeosoma electellum* H.) showed that resistant varietes contained larger amounts of 2 larvacidal diterpenoid acids in extracts of their florets. Since first instar larvae of *Homeosoma electellum* consume florets as the major portion of their diet before burrowing into the immature seeds, the presence of the growth inhibiting chemicals was considered to be the definitive factor in this example of host plant resistance. The 2 substances, trachyloban-19-oic acid (**1**) and the biogenetically related (–)-16-kaurene-19-oic acid (**2**) whose structures had al-