Applied Animal Behaviour Science, 23 (1989) 263–268
Elsevier Science Publishers B.V., Amsterdam — Printed in The Netherlands

Short Communication

Pandiculation: the Comparative Phenomenon of Systematic Stretching

A.F. FRASER

Surgical Research Laboratories, Memorial University of Newfoundland, St. John's, Newfoundland, A1B 3V6 (Canada)

(Accepted for publication 16 February 1989)

ABSTRACT

Fraser, A.F., 1989. Pandiculation: the comparative phenomenon of systematic stretching. *Appl. Anim. Behav. Sci.*, 23: 263–268.

Stretching is a neglected feature among categories of maintenance behaviour. This may be the result of stretching in mammals being perceived as various singular acts. Common and simple forms of stretching among livestock are widely recognized. These have been described as individual acts such as arching of the neck or extending the head or hind leg; forelimb extensions have also been described. In association with stretching, yawning is known to occur sometimes.

Systematic, coordinated stretching occurs in a compound pattern of almost identical general form among many animals in such a way as to extend vigorously and stiffen the extremities and trunk. This phenomenon has gone unidentified as true pandiculation, which is the homologous behaviour in man. Its occurrence in man and animals is alike. Such pandiculation serves as a prime example of an action pattern occurring in domestic mammals. Further study of the comparative nature of this phenomenon could be rewarding, but its current value may lie in the fact that it appears to be a sign of well-being.

INTRODUCTION

On kinesis, Carson (1985) concludes aptly with the statement "Kinesis is an undirected response to stimulation, the response being movement of all or parts of the body as in locomotion or stretching". The latter is a remarkably neglected feature in the study of behaviour. With attention drawn to certain aspects of kinesis among the elemental behavioural needs of animals (Fraser, 1988), this category of maintenance calls for better attention in applied ethology. As a component of this, kinetic activities have been given specific description in current texts (e.g. Fraser, 1980) but they have been neglected in others. One reason may be that stretching has been perceived as a miscellaneous variety of singular acts having little relevance to the applied topics which increasingly relate to welfare, providing it with its rationale in large measure.

0168-1591/89/$03.50

The situation is different with regard to poultry in which the usual forms of stretching are common knowledge.

STRETCHING

Common features

In poultry the common forms of stretching include vigorous extension of one wing after another; also common is the action in which, with one wing being stretched in a backward direction, the leg on the same side becomes extended backwards (Fraser, 1988). In addition, there are periodic upward stretching actions of the head and neck. In other farm livestock, stretching is most often seen after rising; these acts have been described by giving their principal components: arching of the neck, straightening of the back and full extension of one or the other hind leg. Such stretching acts are often seen in series. Extension of the forelimbs, singly or together, has been described as a related exercise. Dogs are commonly seen to stretch their forelegs forward together, while depressing the shoulders and back region. Cats do much of their stretching in the form of, so-called, "claw-sharpening" acts. In the latter there is usually a series of alternating forelimb pulls with the extruded claws anchoring the paw before being plucked free. This latter act terminates the singular stretch.

In association with some stretching episodes yawning may occur among the mammalian subjects mentioned. In other instances it may occur alone in the form of slow and maximal extension of the tempero-mandibular joints. Other localized stretching can involve the tail and even the tongue. The eyes may be shut during some forms of stretching. In contrast, more elaborate regional stretching is seen in such actions as partial rotation or deviation of the head and neck, extension of the carpal or elbow joint and stiffening of the trunk.

While the concept is of musculature being stretched, many of the above actions clearly involve marked joint extension. The atlanto-occipital joint is subject to considerable articulation in some of the above actions. Other major joints which are notably involved in fully extended articulations are shoulder, elbow, carpus, stifle and tarsus. Stretching also occurs in action patterns of almost identical form in the mammalian species in such a way as to extend and stiffen the extremities and trunk. In such patterns of stretching the musculature and articulations involved are, in general, used in striding and righting behaviour.

Pandiculation

Among the forms of stretching which have been given varying degrees of attention is one particular manifestation which has been overlooked as being a homologue of pandiculation as recognized in man. The symmetrical, coordinated stretching and stiffening actions of the body as one unit is true pan-

diculation. This action typically occurs in man and animals alike, as an exertion which sweeps wavelike through the subject's main articular parts, extending them distally. In each pandiculation there is a chain of actions, notably of the head, neck and limbs which are coordinated in stretching; yawning is sometimes involved among these articular extensions. Pandiculation is, in fact, a very characteristic phenomenon with overall stretching as its core. Modern neuroethology has shed light on the physiological background.

The simple form of stretch reflex (myotatic reflex) is typically monosynaptic in nature. The overall reflex evidently involves consciousness and awareness, and permits degrees of voluntary control. Long latency of this overall sequence makes it analogous to polysynaptic "postmyotatic reflexes". Response to muscle stiffness – from myotatic reflex – is a postmyotatic response. The postmyotatic response can serve to restore the limb (and related musculature) to an original (homeostatic) state (Camhi, 1984). Thus the postmyotatic response is homeostatic in formation. This manifestation of homostatic kinesis therefore indicates its status in well-being. Its function is to decrease stiffness and with this there is a circumstantially evident satisfaction. Myotatic reflexes apparently serve to increase stiffness while the postmyotatic can serve to diminish stiffness. (Crago et al., 1976; Friesen and Stent, 1978; Delcomyn, 1980).

Pandiculation conforms to the concept of fixed action pattern in that it has a relatively fixed pattern of coordination which, while appearing stereotyped, has variability in orientation (McFarland, 1987). Being a feature of mammalian (including human) behaviour the degree of plasticity is great and fits better under the concept of modal action pattern (Barlow, 1977; Getting, 1975). Awareness influences these acts (Griffin, 1981).

OBSERVATIONS

A. Special features

Pandiculation as a comparative phenomenon has a core of common characteristics from time to time, from subject to subject and among many species. These characteristics can be listed as follows:
1, extending the arms/forelimbs; 2, extending the legs/hindlimbs; 3, extending the head and neck upward or forward; 4, flexing the vertebral column by depressing it or arching it regionally; 5, stiffening the trunk; 6, yawning.

The above features in animal pandiculation have a high degree of constancy. Among them can be variations such as absence of yawning or exertion at only one pole of the body, i.e. anterior or posterior. Again animal pandiculation can have symmetry in simultaneous or alternating extension of limb pairs. Ob-

viously, all four limbs cannot be easily fully extended simultaneously in the standing subject, although they are typically involved in simultaneous extension in pandiculation when the animal is lying in lateral recumbency. In this latter situation the tetanoid form of the phenomenon is most evident.

Other notable characteristics of pandiculation in animals include those given below:

(a) Polarity. Although the action pattern is not directed in relation to the environment, it has direction in relation to its body-base. It can therefore be recognized as being variously outstretched, upraised, anterior or posterior.

(b) Position. Pandiculation can occur in the two basic positions of upright stance or lateral recumbency.

(c) Totality. The whole pattern of pandiculation may occur in a given manifestation, or recognizable portions of it may be produced. It can therefore be complete or partial.

(d) Periodicity. Many occurrences of pandiculation are in peri-somnolent circumstances, e.g. when the animal is arousing from sleep or as sleep is being initiated. It often also occurs at the end of a period of flexed sternal recumbency. Occurrences are also common, notably in dogs, when there is a change from inactivity to exercise. Furthermore, pandiculations may recur as a series of events in close succession.

B. Clinical features

(i) Illness. Pandiculation is remarkably absent in all forms of general illness. Equally notable is its return to behaviour when the animal is progressing in convalescence and returning to a state of health.

(ii) Diagnosis. It is of prognostic value in appraising a recovery to health. Equally it is of some diagnostic value in ascertaining a state of well-being in an animal which is otherwise clinically sound.

(iii) Age. The complete forms of pandiculation appear to be shown with greater frequency in young animals than in older ones. In the latter, incomplete manifestations are more common.

(iv) Confinement. Whereas it appears that release from confinement or change of locus often induces pandiculation, it is noted that the full pattern cannot be reproduced by the animal until it has sufficient space for the vigorous bodily extensions which are the main feature.

(v) Comfort. Clinical subjectivity affirms that the phenomenon is associated with evident satisfaction. In the animal's bodily and behavioural conditions an element of comfort attainment can be assumed.

DISCUSSION

The stimulus to pandiculation can be assumed to be feedback from stiffness. The role of such feedback in behavioural action has been comprehensively considered by Miles and Evarts (1979). In addition, the phenomenon at times may be in response to a period of asymmetry in position. Zwislocki (1980) has reviewed the role of the cochleovestibular apparatus in relation to relevant circumstances which give grounds to a supposition that pandiculation has an antigravity force to it (Evans and Wilson, 1975; Kandel and Schwartz, 1981).

An interesting minor feature is eye closure in this activity. It may be that the eyes are closed for saccadic suppression, to allow the voluntary action to be performed without the opposing system of optomotor signals which could effectively immobilize the animal. Slow movement also overcomes any influence from optomotor feedback aimed at correcting the body's position when the centre of gravity changes or body angles are changed (Campbell, 1974).

That the phenomenon is homologous in its form and circumstances across so many species is a testimony to its deep evolutionary root. Further study on its comparative nature could be rewarding. The value in recognizing this behaviour as meaningful may now lie in the fact that it appears to be a sign of well-being. The latter is an acknowledged state which applied ethology is attempting to identify. Notice of this phenomenon may give progress in that direction.

The body-based character of pandiculation emphasizes the need for primary space for basic kinetic output and for general comfort. This is a point which has been made before (Fraser, 1982, 1988) but this matter gives further weight to this case which is fundamental to welfare.

REFERENCES

Barlow, G.W., 1977. Modal action patterns. In: T.A. Seboek (Editor), How Animals Communicate. Indiana University Press, Bloomington, IN, 77 pp.

Camhi, J.M., 1984. Feedback in behavior and the nervous system. In: Neuroethology: Nerve Cells and the Natural Behavior of Animals. Sinhauer, Sunderland, MA, Chap., 10, pp. 355–358.

Campbell, F.W., 1974. The transmission of spatial information through the visual system. In: The Neurosciences: Third Study Program. Massachusetts Institute of Technology Press, Cambridge, MA, 98 pp.

Carson, K., 1985. Kinesis. In: A.F. Fraser (Editor), Ethology of Farm Animals. Elsevier, Amsterdam, Chap. 18, pp. 209–214.

Crago, P.E., Houk, J.C. and Hasan, Z., 1976. Regulatory actions of human stretch reflex. J. Neurophysiology. 39: 925–935.

Delcomyn, F., 1980. Neural basis of rhythmic behaviour, in animals. Science, 210: 492–498.

Evans, E.F. and Wilson, J.P., 1975. Cochlear timing properties. Science, 190: 1218–1221.

Fraser, A.F., 1980. Kinetic behaviour In: Farm Animal Behaviour. 2nd edn., Baillere Tindall, London, Chap. 14, pp. 116–122.

Fraser, A.F., 1982. Kinetic behaviour and some of its way. Appl. Anim. Ethol., 9: 107–110.

Fraser, A.F., 1988. Behavioural needs in relation to livestock maintenance. Appl. Anim. Behav. Sci., 19: 368–376.

Friesen, W.O. and Stent, G.S., 1978. Neural circuits for generating rhythmic movements. Anim. Rev. Biophys. Bioeng., 7: 37-61.

Getting, P.A., 1975. *Tritonia* swimming: triggering a fixed action pattern. Brain Res., 96: 128-133.

Griffin, D.R., 1981. The Question of Animal Awareness: Evolutionary Continuity of Mental Experience. The Rockefeller University Press, New York.

Kandel, E.R. and Schwartz, J.H. (Editors), 1981. Principles of Neural Science. Elsevier, Amsterdam, 731 pp.

McFarland, D., 1987. The Oxford Companion to Animal Behaviour. Oxford University Press, Oxford and New York, p. 190.

Miles, F.A. and Evarts, E.V., 1979. Concepts of motor organization. Annu. Rev. Psychol., 30: 327-362.

Zwislocki, J.J., 1980. Five decades of research on cochlear mechanics. J. Acoust. Sci. Am., 67: 1679-1685.