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STEREOTYPIES AS ANIMAL WELFARE INDICATORS

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ABSTRACT

Stereotyped movements form part of the normal behavioural repertoire of animals but a definition for welfare purposes is: a stereotypy is a relatively invariate sequence of movements occurring so frequently, in a particular context, that it could not be considered to form part of one of the normal functional systems of the animal. Stereotypies may sometimes be the result of malfunctions of systems controlling behaviour but they could be used to control motivational state by increasing sensory input in monotonous surroundings or by increasing the average predictability of input in unpredictable surroundings. Their frequency of occurrence should be assessed both in the normal rearing conditions and when there is human disturbance. The effects of stereotypies on the animal's body and on the pen can also be assessed. Examples of studies where rearing condition changes have reduced the incidence of stereotypies are quoted. Whatever the function of stereotypies, if they occupy much time, say 10% of waking life, the conditions could be said to be bad for the welfare of the animal. Stereotypy incidence, however, is just one of several measures which must be combined when assessing responses to adversity.

STEREOTYPIES IN RELATION TO OTHER ACTION PATTERNS

The behavioural repertoires of animals include many examples of sequences of movements which are repeated in a relatively invariate way. Such action patterns vary more or less in different circumstances and some of their components are less variable than others (Broom, 1981 p.62). For example the components of drinking by domestic chicks (Dawkins and Dawkins, 1973), display by fish (Barlow, 1977) and calling by birds (Schleidt, 1982). Action patterns are often said to be stereotyped if they do not vary much in: the number of elements in repetitions of the pattern; the degree of coupling between those elements; and the fidelity of repetition of the whole pattern including the size, duration, speed of movement and position of each component (Schleidt, 1974). Many observations are needed before such lack of variation is apparent so, in practice, sequences of movements are not referred to as stereotyped unless many repetitions have been recorded. The repetitions need not be successive for other activities may be interpolated.

Activities such as breathing, walking, drinking, or grooming may be relatively stereotyped and are not qualitatively different from the stereo-

typies sometimes shown by zoo animals, farm animals, autistic children, or people waiting in hospitals or at bus stations. For welfare purposes a stereotypy may be defined as a relatively invariate sequence of movements occurring so frequently, in a particular context, that it could not be considered to form part of one of the normal functional systems of the animal, feeding, body maintenance, reproduction, etc. Some stereotypies are incomplete (van Putten, 1982), in that they have lost elements of the original functional action pattern but others are not distinguishable in quality from actions which occur normally, e.g. pacing movements.

IDEAS ABOUT THE FUNCTIONS OF STEREOTYPIES

In many early studies of stereotypies it was assumed that they represented malfunctions of systems controlling behaviour and this may be correct in some circumstances. Neurochemical work has demonstrated links between the occurrence of stereotypies and dopaminergic pathways in the brain. For example, injection of the domamine receptor agonist apomorphine into piglets, cattle and sheep increases the incidence of stereotypies (Sharman and Stephens, 1974, Fry, Sharman and Stephens, 1976, see also papers by Sharman and Oliverio in this volume). Apomorphine injected into rats also elicits stereotyped sequences of exploratory behaviour (Szechtman et al., 1980). These findings do not provide answers concerning the function of stereotypies although the interactions between the endorphin system and their occurrence indicate that stereotypies and morphine-like substances may sometimes have similar effects on the brain.

Since stereotypies produce a sensory input and sensory input affects motivational state, it is possible that animals may use stereotypies to modify their motivational state. Hutt and Hutt (1965) suggested that stereotypies in autistic children "may serve to maintain arousal within acceptable limits" and Fentress (1976) considered that stereotypy might be a means of combatting overload. Animals subjected to a low rate of change of sensory input could increase input by carrying out stereotypies and, since sensory input during stereotyped movement is very predictable, animals in situations where events are highly unpredictable could increase the average predictability of input by carrying out stereotypies (Broom, 1981 p.99). If the number of operational attention channels were limited the individual might thus reduce the necessity to process and respond to inputs from unpleasant stimuli. Forrester (1980) has developed the idea

that the repetition of a single behaviour pattern could be used to alter causal factor levels and hence motivational state. The behaviour might be simple, as in the bill-shake of a domestic fowl (see also Hughes, 1982) or more complex as in route-tracing stereotypies of zoo or farm animals.

SITUATIONS RESULTING IN THE OCCURRENCE OF STEREOTYPIES

Stereotypies are often shown by animals in monotonous environments and by those in situations of novel stimulation or high anxiety (Hinde,1970, p.557). They are most likely to develop in animals which have been reared in monotonous environments and then severely disturbed. As Meyer-Holzapfel (1968) notes, deprivation of a specific attribute of the surroundings, such a sleeping box or a companion, as well as monotony resulting from restriction of movement, may elicit stereotypies. The "high anxiety" may result from the presence of a potential predator, such as man, or a delay in time of feeding. A problem for experimenters in this field is to decide whether the occurrence of stereotypies is solely a response to the restricted conditions in which the animal is kept or is in part a response to the presence of the observer.

Stereotypies shown by sows which are tethered or in pens allowing restricted movement only include those listed in Tables 1 and 2 (Fraser,

TABLE 1. Effects of straw on the occurrence of stereotypies in tethered sows.

Behaviour	% of 1 min. periods in which behaviour occurred	
	Straw	No straw
nose or lick bars, trough or chain	5	21
bite bars or chain	4	10
bite, nose or lick neighbour's tether	1	3

(data from Fraser, 1975)

1975). It is apparent from Table 1 that tethered sows spend much time nosing, licking or biting the accessible parts of their pens and that the presence of straw reduces the incidence of these activities. The sows supplied with straw spend much time chewing and manipulating straw, activities which are much more varied than the stereotyped licking and biting. The possibility that straw ingestion causes the behaviour

changes can be discounted after a further experiment by Fraser in which straw was provided (1) on the floor and in the trough (3 kg per day), (2) in the trough (1 kg), (3) chopped in the trough, or (4) not at all.

TABLE 2. Effects of straw presence and straw in diet on the occurrence of stereotypies in tethered sows.

Behaviour	% of time standing that behaviour occurred			
	3 kg straw	1 kg straw in trough	1 kg chopped straw (eaten)	No straw
nose or lick bars, trough or chain	3	11	34	31
bite bars or chain	5	11	37	43
head wave	1	6	11	21
stretch mouth	0	2	4	4

(data from Fraser 1975)

Most of the chopped straw was eaten and the data in Table 2 show that the presence of straw which can be manipulated was a major factor reducing the incidence of stereotypies. Similar effects of straw on the incidence of stereotypies have been reported for individually housed calves (Unshelm, Andreae and Smidt, 1982) but, as can be seen in Table 3, there may be variation amongst individual calves, or amongst sets of calves, in the stereotypy which they show so several measures are needed.

TABLE 3. Effects of straw on the occurrence of stereotypies in individually housed calves.

Behaviour	% of time showing behaviour		
	straw	no straw (1)	no straw (2)
gnawing at wood	3	5	8
tongue playing	3	6	1

(data from Unshelm, Andreae and Smidt, 1982)

Both of the above examples suggest that stereotypies are shown as a response to restricted, monotonous surroundings. The provision of straw increases the variety of the surroundings and makes possible a more normal activity, i.e. chewing and manipulating the straw. It is likely that other kinds of added variety in the surroundings would have a similar effect but the specific inputs obtained from something taken into the mouth may be the most effective stimuli for reducing the incidence of stereotypy. At some times in life the lack of a specific stimulus or set of stimuli may elicit stereotypies, for example the pacing shown by hens shortly before laying if they do not have access to a suitable nest site (Wood-Gush, 1972, Brantas, 1980, Table 4). Stereotypies may also be shown

TABLE 4. Effect of lack of nest access on pacing by hens: last hour before laying.

	Access to nest	No access
Paces	105	434

(data from Brantas, 1980)

when food is lacking or when social companions are removed.

In many studies in which the occurrence of stereotypies is reported, they are initiated by or increased in rate or intensity by some disturbance. Fentress (1976, 1980) reported that disturbance by a human observer increased rates of circling movements by caged voles Clethrionomys and caused caged hunting dogs Lycaon to revert to the original version of a locomotor stereotypy which included jumping over an object no longer present. He also reported that grooming movements by mice in unfamiliar surroundings are more stereotyped than are those shown in the home cage. Many observations of zoo animals and farm animals are made when the subjects have been disturbed by human observers. As mentioned earlier, the presence of a human observer may result in the exaggeration of stereotypies which are performed when not disturbed but statements about the frequency of stereotypies should refer to their frequency in normal rearing conditions and when there is human disturbance.

The prolonged performance of stereotypies by animals in their normal housing conditions may be detected by observing them or by their effects. Repeated biting movements may wear away wooden bars in the pen and rubbing movements may produce smoothed areas on the bars or wall which are rubbed most. Biting may lead to measurable tooth wear and self biting may result in mutilation. Regular rubbing movements may cause sores on the body.

WHAT STEREOTYPIES TELL US ABOUT WELFARE

Stereotyped movements form part of the normal behavioural repertoire of animals but the occurrence of prolonged stereotypies indicates that the conditions are adverse for that individual. Whether the stereotypy occurs as an accidental consequence of some neural mechanism malfunction or as a means of coping with conditions by modification of motivational state as suggested above, it is a useful indicator that the animal is under stress (see Broom, in press). If the stereotypy occurred for 10% of the animal's waking life, or if it caused bodily injury, it could be said that the conditions are bad for the

welfare of the animal. Responses to adversity may be of various kinds, however, for there are other behavioural responses such as apathy and physiological responses such as high sensitivity of the adreno-cortical system or high levels of endorphin production. Hence it is desirable for the various measures to be combined in order to detect adversity. One animal may show mainly stereotypies as a response while another may show a combination of lower levels of stereotypies with other responses.

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