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Peter CROWCROFT

A Simple Technique for Studying Activity Rhythms of Small Mammals by Direct Observation

Prosta technika badania aktywności małych ssaków za pomocą bezpośredniej obserwacji

INTRODUCTION

During my first visit to the Mammals Research Institute at Białowieża in May 1959, I had the pleasure of discussing with Dr. Jan Słomka, the applicability of various mechanical, electrical, and photographic devices to the study of the activity of small mammals in the laboratory. Our discussion led me to prepare this note which briefly describes a simple technique evolved in 1956 to test the practicability of studying the activity rhythms of captive small mammals without any mechanical equipment except a clock. Pressure of other duties has prevented me from using the technique for an exhaustive study, but these remarks may prompt other workers to explore its possibilities.

The provision of mehanical or elektrical aids for recording the activity of small mammals is usually intended to increase productivity and objectivity. The apparatus continues to gather information all day and night, while the investigator remains within the framework of his own activity pattern. This is more comfortable, and supposedly frees him for more productive activities. In addition, the information obtained by counting mechanism or revolving drums is re-assuringly quantitative.

It may be argued, on the other hand, that many man-hours can be wasted in building recording equipment which does not operate, simply because the experimental animals do not behave like machines. Some mice and shrews display remarkable obstructive powers, storing food under platforms, urinating on electrical contacts, and so on. At times in fact, the animal comes to be regarded as something which interferes with the experiment. The aesthetic attractions of apparatus, particularly electronic equipment, are considerable, and its construction can be an end in itself, but in a zoological study surely the animals should be the objects to which most thought is devoted.

It must be remembered also that information can be both objective and quantitative, even statistically significant, without being relevant. Detailed analysis of data obtained by means of counters and revolving drums can impart an illusory appearance of accuracy to measurements which are only broad expressions of relative changes in unspecified or unnatural activities.

It was with these considerations in mind that attempts were made to test the possibility of keeping a shrew (*Sorex araneus* L.) under constant observation and recording its movements without interfering with it in any way.

METHOD

The shrew was confined in a vivarium measuring 125×54 cm. furnished with food and water pots, and four small shelters. Dried grass was scattered about, and after a few days the shrew made runways through this and collected some of it into a nest. Grass was then gradually stolen from the shrew until it could be easily seen, even when at rest within its nest.

The vivarium rested on the floor, and the observer sat at a small table from which the entire cage could be surveyed by only a movement of the eyes. A large clock was also in view. A scale-drawing of the cage and its contents was made and many copies reproduced with a duplicating machine. As each plan was intended to serve for five minutes' recording, a column of five divisions was provided at one side, for making abbreviated supplementary notes (figure 1), particularly when the animal was stationary (A = awake, F = feeding, D = drinking, N = napping, R = running).

Four coloured pencils were arranged in line between the left forefinger and thumb, a fifth being in use in the right hand, and as each minute ended the pencil in the right hand was replaced at the end of the row, and a fresh one taken from the other end, thus coming back into use for the first minute to be recorded in the next plan.

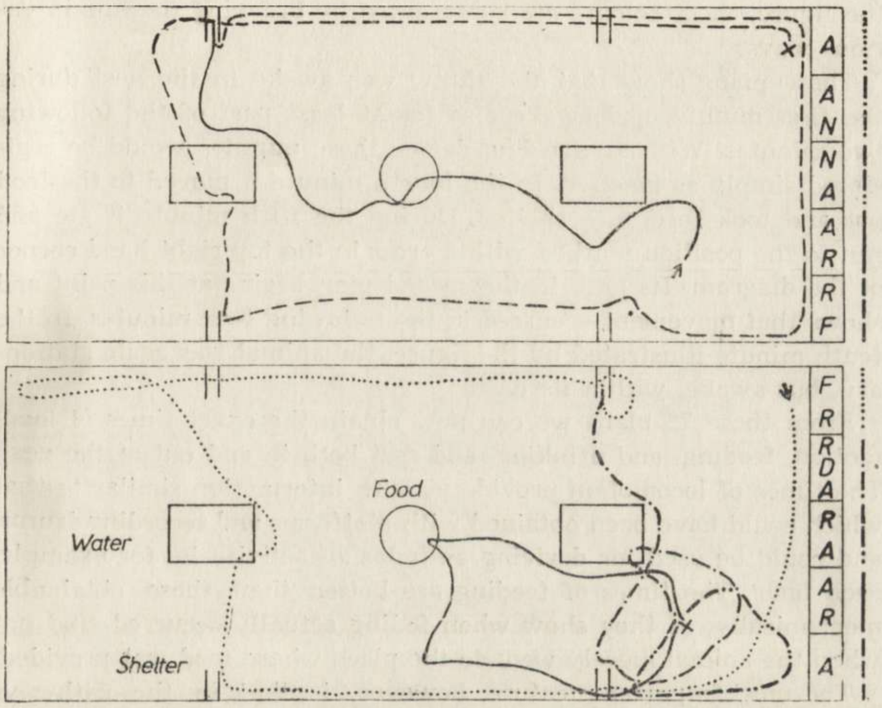

Fig. 1. Two plans of a vivarium containing a common shrew (*Sorex araneus* L.) showing the animal's movements during two successive five-minute periods. The distances moved were approximately 510 and 615 cm. See text for further details.

When the shrew moved, its path was traced on the scale-drawing with the pencil. With a little practice, it was possible to trace the animal's movements quite accurately, using the objects in the cage as reference points. The shrew was watched for six hours, a relief observer taking over for the middle two, as two hours appeared to be the maximum time one person could maintain the intense concentration necessary. Thus 72 plans were needed to supply a complete record of the distances moved by the shrew during six hours, and the times during which movement took place.

RESULTS

The plans for two successive five-minute periods are shown in figure 1. The direction of the shrew's paths is much clearer in the original plans because of the use of five colours in strict sequence. In the figure, these colours are represented by breaking the line in various ways.

These plans show that the shrew was awake in the nest during the first minute, and awake also for at least part of the following two minutes. With a recording device these minutes would be registered simply as inactive. In the fourth minute it moved to the food pot and took food to a shelter. During the fifth minute it ate and ran to the position marked with a cross in the top right hand corner of the diagram. Its path in the second plan begins at this point and shows that movement occurred in the following four minutes. In the tenth minute illustrated by the figure, the animal was again stationary, but awake, within its nest.

From these 72 plans we can now obtain the exact times of locomotion, feeding, and drinking, and rest both in and out of the nest. The times of locomotion provide us with information similar to that which could have been obtained with platforms and recording drums, and could be used for deriving an index of activity in, for example, each hour. The times of feeding are better than those obtainable mechanically, as they show when feding actually occurred, and not when the animal merely went to the place where food was provided.

The most important feature, however, is that in the pathways marked on the plans we have a direct measure of the animal's energy expenditure on locomotion in each minute. These pathways were converted to actual distances moved simply by tracing over them with a map-measuring wheel and converting to centimetres according to the scale of the plan (Table 1).

These quantities, although for only six out of the 24 hours, and for six hours in which the shrew exhibited no major fluctuations in activity, show a similar pattern to that of the activity of shrews recorded mechanically (Crowcroft, 1954). Obviously, a record during the whole 24 hours would be of far greater interest, but at the time of conducting this experiment such an undertaking was impracticable [1]).

[1]) See page 110.

Table 1.

Locomotion of *Sorex araneus* L. from 10^{00} to 16^{00} G.M.T. 3 December 1956. Distances converted to centimetres. Basic unit = 17.57 cm.

Hours	Five-minute Intervals												
	0–5	–10	–15	–20	–25	–30	–35	–40	–45	–50	–55	–60	Total
10–11	105	176	527	808	0	597	0	826	88	0	510	615	4252
–12	791	228	0	246	0	703	633	316	158	123	1388	246	4832
–13	457	264	0	299	527	387	0	158	0	123	123	18	2356
–14	439	176	334	668	404	0	35	35	545	457	70	0	3163
–15	0	457	88	439	0	334	0	35	439	0	35	387	2214
–16	0	246	597	35	299	580	35	439	264	123	0	0	2618

Such direct observation of captive animals can unexpectedly throw light on other problems. For example, it is not known whether or not feeding from the anus (so-called refection, or coprophagy) is a rhythmical activity in the shrew, and whether or not it is associated with any particular phase of the daily activity pattern. That such a correlation exists is suggested by the times at which refection occurred in the individual studied in this particular experiment. Within the six hours of continuous observation (10.00 to 16.00) refection occurred only from 14.23 to 14.25 and again shortly afterward at 14.35 and 14.38. This fifteen minute period falls within the times of the afternoon depression in the general activity of common shrews in the laboratory.

SUMMARY

A simple technique for studying the activity of small mammals in captivity is described. The movements of a shrew (*Sorex araneus* L.) were marked with coloured pencils on a duplicated series of plans of its cage, and later converted to actual distances moved in each time unit, by retracing the paths with a map-measuring wheel.

REFERENCE

1. Crowcroft, P. — The daily cycle of activity in British shrews. Proc. zool. Soc. Lond., Vol. 123 (IV): 715—729. 1954.

Zoology Department,
British Museum (Natural History)
London, S.W. 7

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[1]) Recording by direct observation was undertaken for long periods on another occasion, when house mice were watched continuously for three days and nights. The mice, living in a room six metres square, were watched through a hole in the ceiling. A dim red light supplied illumination at night. It was quite clear that consistent recording was possible with three observers, and that the data obtained was of far greater relevance to the actual biology of the species, than that obtainable by indirect means.

STRESZCZENIE

Autor opisuje prostą technikę badania aktywności małych ssaków w niewoli. Drogi poruszania się ryjówki (*Sorex araneus* L.) oznaczano kolorowymi ołówkami na powielanych planach klatki. Przy pomocy kółka do mierzenia odległości na mapie, określano długość linii na planach a następnie obliczano rzeczywiste odległości, które zwierzę pokonało w każdej jednostce czasu.

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