first object to elicit social responses on the part of the young[4], and in this case the first object must have been either the mother or other members of the litter. In addition, the tameness is not specific, as is often the case in imprinting, but is general, extending uniformly to unfamiliar people. Most of the opossums will also show curiosity rather than fear when placed on the floor in contact with other animals from the laboratory, such as cats and pigeons. Furthermore, the opossums as adults show normal social dominance fighting among the males and appropriate sexual behaviour directed at other opossums; none of this behaviour is directed at human beings. The acceptance of people, the lack of defensive biting, and normal responding to other members of their species is very similar to the behaviour of tame dogs. It may be significant that the period during which contact with humans leads to tameness is virtually identical for the opossum and the dog[3]. For both species it is between the time the eyes open and weaning.

The role of feeding does not appear to have been important in the observed taming. The two wild young discussed earlier and the mother of litter III became no tamer as a result of being fed by the author. On the other hand, the pups of litter III, which were nursed by their mother, were tame before they were weaned. It is interesting to note that with litter III the mother's open mouth warning stance in response to approach had no effect on the pups; they would investigate the offered hand, showing no fear. An important aspect of this investigation is that all three litters were from mothers caught in the wild with pouch young. Therefore, possible selective factors which are necessarily involved with domesticated or laboratory-bred animals did not enter into the observed tameness of the young. Since early contact with human beings appears to be a critical factor in determining the success of taming the opossum as well as the dog, which is phylogenetically more recent, it is possible that this factor would be of importance in the taming of any mammal. These results viewed in relation to previous observations of dogs[1] and cattle[5] suggest that members of domesticated species are tamed anew each generation as a result of the tame mother allowing her young contact with human beings during a period of socialization.

This work was supported by grant *M*–3917 from the U.S. National Institute of Mental Health to Norman Guttman, and grant *G*18124 of the U.S. National Science Foundation to Robert P. Erickson. I thank David A. Marshall for his assistance.

Herbert Friedman*

Department of Psychology,
Duke University.

* Now at the College of William and Mary, Williamsburg, Virginia.

[1] Scott, J. P., *Science*, **138**, 949 (1962).
[2] Hamilton, W. J., *Nat. Hist.*, **72**, 16 (Feb. 1963).
[3] Elliot, O., and Scott, J. P., *J. Genet. Psychol.*, **99**, 3 (1961).
[4] Hess, E. H., in *Nebraska Symp. Motivation*, **44** (Univ. of Nebraska Press, Lincoln, 1959).
[5] James, W., *Psychology: Briefer Course*, 400 (Collier, New York, 1962).

Eating Behaviour induced by Sounds

In the course of pretraining hungry rats in a visual discrimination apparatus it was observed that background noise often was followed by a complex chain of behaviour involving chewing, approach to food, and eating. Similar behaviour had been noted in rabbits and guinea pigs. This phenomenon was examined in a series of 40 male Sprague–Dawley rats weighing 250–300 g.

The animals were starved for two days, and were then placed in an open box 1 ft. high, 1·5 ft. wide, and 3 ft. long. Wet mash was available in a small dish at one end. The animals were allowed 10 min of exploration and eating, and test stimuli were presented at irregular intervals. The stimuli included clicks, hand claps, and whistles of various frequencies, as well as steady and blinking light. Most animals explored extensively, sniffed the food, but ate little or nothing. On this first day, sounds tended to increase activity, but only 18 of the 40 animals ate on the presentation of the sounds. The animals were returned to their home cages and given 6 g of dry pellets. On the second day most animals did very little exploring. To varying degrees, all animals, including those that had not eaten on the first day, showed sound-induced eating behaviour. Some animals ate only during the sound stimuli. In general, low-intensity sounds (60 db.) induced chewing, higher intensities (70 db.) induced movements toward the food, and still higher intensities (80 db.) induced active eating (clicks and whistles measured with a General Radio 1551–*B* sound-level meter, room noise 54 db.). The vigour of the patterns was related to the intensity and duration of the stimulation. A series of clicks was sometimes associated with chewing motions in exact synchrony with the stimuli, at rates up to 2–3/sec. Some animals abruptly ceased eating on termination of the sound, and could be started and stopped repeatedly throughout the 10-min period. Flashes of light or increases of background lighting were not effective. However, sound stimuli were not unique. In situations involving avoidance conditioning of restrained rabbits, chewing and eating during and immediately after an electric shock was observed—the shock never having been previously paired with eating.

The type of behaviour potentiated was specific to the drive state of the animal. Thus, with food and water available, sounds induced drinking in thirsty animals. However, one of five animals examined later while fully satiated still exhibited a moderate degree of sound-induced eating. Other behaviour patterns elicited by the sounds included crouching and freezing, exploration, and grooming. The closer the animal was to the food, the more likely eating rather than freezing would be observed. Such patterns suggest that these observations can be incorporated within the framework of the ethological concept of 'displacement activity'[1].

It should be emphasized that some animals that had merely sniffed the food showed the full eating behaviour pattern immediately on the first presentations of the stimuli. Thus, a seemingly simple 'neutral' stimulus possessed the property of eliciting a complex chain of behaviour. Since the full response was seen in cases where the stimulus was never formally paired with it, the stimulus could be considered an unconditioned stimulus—the unconditioned response consisting of the appetitive and consummatory eating behaviour.

Meyers[2] has recently emphasized a need for a consideration of the 'neutrality' of stimuli. It has been well documented that simple stimuli may markedly differ in such things as efficiency as a conditioned signal, or potency for arousing an animal[3,4]. The present observations re-emphasize that stimuli may differ along dimensions that are frequently ignored or unsuspected. In particular, these observations are relevant to the problem of secondary reinforcement and 'cue' properties of stimuli[5], and the interpretation of experiments in which brain stimulation induces complex behaviours.

This work was carried out during the tenure of a predoctoral research fellowship from the U.S. National Institute of Mental Health.

Irving Kupfermann

Division of Neurology,
Stanford Medical Center,
Palo Alto,
California.

[1] Tinbergen, N., *The Study of Instinct* (Clarendon Press, London, 1951).
[2] Meyers, J. L., *Psychol. Bull.*, **55**, 284 (1958).
[3] Fink, J. B., and Patton, R. M., *J. Comp. Physiol. Psychol.*, **46**, 23 (1953).
[4] Saavedra, M. A., Garcia, E., and Pinto-Hamuy, T., *J. Comp. Physiol. Psychol.*, **56**, 31 (1963).
[5] Bugelski, R., *The Psychology of Learning* (Holt, New York, 1956).

© 1964 Nature Publishing Group