Effect of domestication on avoidance learning in the Norway rat

ROBERT BOICE,² *University of Missouri at Columbia, Columbia, Mo. 65201*

Wild rats (Rattus norvegicus) in three stages of laboratorization were outperformed by domesticated (albino) rats in a two-way shuttlebox task. Avoidances in wild F₁ laboratory-raised rats and in wild-caught laboratory-habituated rats were equivalent and exceeded avoidances in newly captured rats. Shuttlebox behaviors of all undomesticated rats were inflexible and emotional as compared to albino rats.

Periodic criticisms of the use of domesticated (e.g., albino) rats in learning research suggest that psychology's favorite preparation exhibits artificial behaviors that are not phylogenetically generalizable (Beach, 1950; Lockard, 1968). Such criticisms often include the notion that domestication of the rat has produced degeneracy and a probable drop in learning ability (Robinson, 1965). The belief in a superior learning ability of the wild rat persists without experimental support. For example, Stone (1932) speculated that wild strains "may actually possess a greater native learning ability" [p. 50], even though his genetically wild Ss were too intractable to be maze trained.

It is also possible to conceive of the laboratory rat as having been selectively bred for "cooperativeness" in learning situations (Tinbergen, 1965). In learning an anticipatory licking response, laboratory rats are markedly superior to wild rats (Boice, 1968). The conditioned licking paradigm, however, does not elicit unconditioned responding automatically, and it can be argued that the more neophobic wild rats were at a comparative disadvantage. The present study compared avoidance learning in a situation where consistent unconditioned responding was effected in both wild and laboratory rats.

SUBJECTS

The Ss were 10 adult female rats (*Rattus norvegicus*) of each of four stocks: (a) wild-caught rats tested 1 day after capture, (b) wild-caught rats tested 3 months after capture, (c) F₁ progeny of wild-caught rats bred in the laboratory, and (d) albino (Sprague-Dawley) rats. Wild-caught rats were selected from a land-fill with an unstable habitat, since trap-sampling of more stable habitats may yield mostly low-social-status captives (Boice & Boice, 1968). All Ss were housed

individually from capture or weaning, with free access to water and Wayne Lab Blox. None of the rats had a known history of handling.

APPARATUS

The shuttlebox had two chambers, each 50 x 15 x 50 cm high, one white and one black, separated by a guillotine door. The Ss were observed via overhead mirrors. Stainless steel grids, spaced 1.5 cm center to center, were charged, when appropriate, in series with neon bulbs (NE 2) with 200 microamperes at 40 V dc as a base level.

PROCEDURE

Transfers were made with a plastic handling box (Tighe, 1965). All Ss were trained for 200 consecutive trials, 100 trials in each direction, in a single session. Shock intensity was temporarily increased when Ss failed to respond to shock onset with locomotion.³ Trials were signaled by the opening of the guillotine door. If the rat failed to cross to the opposite chamber (avoid) within 5 sec, shock was delivered to the chamber until the rat escaped by crossing to the opposite chamber. The door was closed immediately after the rat avoided or escaped. Half the rats in each group had a 10-sec ITI in the black chamber and a 100-sec ITI in the white chamber, and half the rats had the opposite combination.

RESULTS

Figure 1 depicts the course of avoidance and squealing responses during the ITI in the four groups.

The overall level of avoidance responding from the 10-sec ITI toward the 100-sec ITI ($F = 367.68$, $df = 1/36$, $p < .001$) replicates earlier research (Weisman, Denny, & Zerbolio, 1967). There was no apparent effect of white vs black chamber. Differences in avoidance responding between groups were significant $F = 17.10$, $df = 3/36$, $p < .001$, as the albino rats clearly outperformed all undomesticated groups. A Duncan range test of avoidances from the 10-sec ITI in the last 20 trials indicated reliable differences ($p < .01$) between all but the wild F₁ and the wild 3-months-in-captivity groups. Avoidance learning from the 100-sec ITI (i.e., toward the side with the shorter ITI) was negligible in all three undomesticated groups.

Squealing responses (Fig. 1) differed significantly between groups ($F = 18.82$, $df = 3/36$, $p < .001$). Duncan range tests indicated reliable differences ($p < .01$) in

the final 20 trials in either direction only between the wild 1-day-in and wild 3-months-in groups.

DISCUSSION

Where responses were made toward the shuttlebox chamber with the longer ITI, avoidances in the wild-caught rats improved as a result of 3 months of captivity. Thus, longer nonshock confinement and longer laboratory habituation both seem to have acted as "relaxation" agents that mediated avoidance responding (Denny, 1969). Similarly, Denniston (1959) found that ground squirrels habituated to the laboratory learned an avoidance response more thoroughly than recently caught squirrels. The wild F₁ rats of this study were raised in captivity but avoided shocks no better than the wild 3-months-in-captivity group. This suggests that habituation to captivity improves avoidance performance of genetically wild rats but not to the level of domesticated rats. Unpublished research in our laboratory indicates an increasing superiority in avoidance responding of

Fig. 1. Avoidance responding (upper graph) and squealing (lower graph) in Norway rats of four groups: albino, wild F₁ laboratory raised, wild-caught and in the laboratory 3 months before testing, and wild-caught and 1 day in the laboratory before testing. Performance in the 200 trials is dichotomized into responses toward each chamber.

albino over wild F_1 rats as the longer ITI is increased beyond 100 sec.

Previous research suggested that an inflexible neophobic type of responding was the primary deterrent to the development of a high level of conditioning in wild rats (Boice, 1968). In the present study, shuttlebox behaviors in undomesticated rats were comparatively stereotyped and rigid. For instance, ITI behaviors in the undomesticated rats were typified by a complete lack of movement until the ensuing trial. Intertrial interval behaviors in the albino rats were rigid only until avoidance responding began, and then grooming, sniffing, and other movements became the rule. Thus, while the transition from escape to avoidance learning in the domesticated rats is seemingly accompanied by "disinhibiting" behaviors (cf. Fentress, 1968), the undomesticated rats do not show similar behavioral changes. The inhibitory response style of the wild rats was probably related to a comparatively high state of emotion. Of a variety of behaviors observed in the shuttlebox, squealing responses differentiated the groups most clearly. The albino rats appeared to be the least emotional group and, accordingly, had the lowest level of squealing (Fig. 1). Prior observations had indicated that the wild F_1 rats would squeal more than the wild-caught rats. This may mean that the early experience of confinement in captivity for a genetically wild rat is critically different from confinement following early experience in nonconfinement.

Clearly, the emotionality of the wild rat does not suit it to learn a two-way shuttlebox task or, possibly, any conventional laboratory learning task. Barnett (1967) notes that, although stereotyped neophobic behaviors in the wild rat have obvious survival value, they are "automatic," undiscriminating, and not "intelligent" behaviors. Wild animals appear to occupy niches where unexpected events are rare (Kavanau, 1967). Observations of wild rats indicate that learning is atypical in adulthood. Thus, it is conceivable that only in domestication, where the preoccupation is with boredom and not predation (Hediger, 1964), will an animal acquire both the ecotype and the genotype to encourage a continual emphasis on learning behaviors.

The results of this study suggest that domestication has not caused a decrease in the learning ability of the Norway rat. Moreover, it indicates that domesticated rats may be suitable for use in formulation of basic learning principles, especially where generalization is to domesticated man. Undomesticated rats might then be

studied for such richer behaviors as aggression in situations where evolutionary principles are sought.

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NOTES

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2. Requests for reprints should be sent to R. Boice, Department of Psychology, 209 McAlester Hall, University of Missouri, Columbia, Mo. 65201.
3. Only the albino rats required temporary shock intensity increases to produce running to shock onset. In a previous study (Boice, Denny, & Evans, 1967), failure to prevent "freezing" responses in albino rats produced an equivocal comparison of avoidance behaviors in domesticated and undomesticated rats.

Amnesia from ECS: The effect of pairing ECS and footshock¹

JOHN L. JAMIESON and D. J. ALBERT,
University of British Columbia, Vancouver, B.C., Canada

An attempt was made to repeat the finding of Schneider & Sherman (1968) that apparent amnesia results from the pairing of footshock and ECS independently of passive-avoidance training. Pairing of footshock and ECS 5 h after training was not found to cause a retention deficit, whereas ECS immediately after training resulted in memory loss. This result shows that the "aftereffects" demonstrated by Schneider and Sherman are not general enough to account for all reported ECS-induced amnesia.

The lack of retention shown by animals receiving electroconvulsive shock (ECS)

shortly after training has been taken as evidence that memory requires a period of time to consolidate (see McGaugh, 1966). Recently, Schneider & Sherman (1968) have demonstrated that apparent amnesia can be produced by the temporal contiguity of footshock and ECS independent of the training-ECS interval. They showed that ECS .5 sec, but not 30 sec, after training on a step-down task produced amnesia; they then went on to show that ECS 6 h after training also produced amnesia when it followed a footshock by .5 sec but not 30 sec. Schneider and Sherman suggest that the temporal contiguity of footshock and ECS produces "aftereffects" that impair performance of a freezing response, thus giving the appearance of amnesia for the passive-avoidance training. Deutsch (1969)