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Social Influences on Rats' (*Rattus norvegicus*) Preferences for Flavored Foods, Scented Nest Materials, and Odors Associated With Harborage Sites: Are Flavored Foods Special?

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We undertook in several experiments to determine whether the enhanced preference an observer rat (*Rattus norvegicus*) exhibits for a food after it interacts with a demonstrator rat fed that food reflects a general enhancement of the observer's preference for objects smelling like the food its demonstrator ate or results from a change in olfactory preference specific to foods. After an observer rat interacted with a demonstrator, it exhibited an enhanced preference for either cinnamon- or cocoa-flavored food that its demonstrator had eaten, but no change in its preference for similarly scented nest materials or nest boxes. The results are not consistent with the view that social influence on food choices of rats reflects a general enhancement of rats' preferences for objects bearing scents previously experienced while interacting with conspecifics. Rather, social influences on odor preferences appear to be restricted to scented foods.

For more than a decade, this laboratory has been engaged in studies of social influence on diet selection by Norway rats (*Rattus norvegicus*). The results of these studies have been remarkably consistent: After a naive rat (an observer) interacts with a recently fed conspecific (a demonstrator), the observer exhibits an increase in its preference for whatever food its demonstrator ate (for reviews, see Galef, 1986, 1988, 1994).

Several lines of evidence are concordant with the view that the changes in diet preference exhibited by observer rats after they interact with recently fed demonstrator rats occur when observers experience food odors in association with conspecifics (Galef & Wigmore, 1983). For example, when observer rats were allowed to smell but could not physically contact anesthetized demonstrator rats that had been dusted with either a cinnamon- or cocoa-flavored food, the observers developed preferences for the foods eaten by their respective demonstrators. On the other hand, observer rats allowed to smell rat-sized surrogates, constructed of cotton batting and dusted with either cinnamon- or cocoa-flavored food, did not exhibit changes in their preferences for foods flavored with cinnamon or cocoa (Galef, Kennett, & Stein, 1985; Galef & Stein, 1985; Galef & Wigmore, 1983).

To date, such studies of social influence on rats' preferences for scents have focused almost entirely on socially induced changes in rats' preferences for scented foods. Consequently, we do not know whether changes in diet choice exhibited by observer rats after interacting with conspecific demonstrators reflect a general enhancement of appetitive responses to scents experienced in association with demonstrators or if exposure to demonstrators affects observers' later responses to such scents only when they are associated with foods.

From Zajonc's (1968) hypothesis that in general, mere exposure to a stimulus tends to enhance hedonic response to it, one may expect that any exposure to an odor will result in increased preference for objects bearing that odor. Unfortunately, the effects of exposure on preference in animals (and humans) are considerably more complex than Zajonc initially proposed (for reviews, see Berlyne, 1970; Hill, 1978; Rozin & Vollmecke, 1986), and as mentioned earlier, in the paradigms used in previous experiments in this laboratory, simple exposure to an odor has had little effect on rats' later preferences for foods that emit it.

Experiment 1

In Experiment 1, observer rats were first exposed to conspecific demonstrators that had eaten either a cocoa- or cinnamon-flavored diet. The observers were then tested to determine both their preferences for cocoa- and cinnamon-scented nest materials and their preferences for cocoa- and cinnamon-flavored foods.

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Method

Subjects

Twenty-four experimentally naive, 42-day-old, female, Long-Evans rats (*Rattus norvegicus*) born in the vivarium of the McMaster University Psychology Department (Hamilton, Ontario, Canada) to breeding stock acquired from Charles River Canada (St. Constant, Quebec, Canada) served as observers in Experiment 1. Twenty-four 49- to 56-day-old, female, Long-Evans rats, which had served as observers in other experiments, served as demonstrators.

Apparatus

The demonstrator rats were housed individually in 20 cm wide × 18.5 cm high × 24 cm long hanging cages in a room separate from the observers.

The observer rats were established in individual hanging cages (40 × 18.5 × 24 cm) with front walls and floors of galvanized wire mesh and back walls and sides of galvanized sheet metal. During the nest-material-choice test (Step 4 of the *Procedure*), two stainless steel feeding bins, mounted outside and at opposite ends of the wire-mesh front wall of each hanging cage, each held a single 23-cm length of 1.25-in. (3.2-cm) diameter polyvinyl chloride (PVC) tubing. Each PVC tube contained 15 g of nest material, which had been made by passing two 8.5 × 11 in. (21.6 × 27.9 cm) sheets of 20-lb bond typing paper through a paper shredder (PS 30 Compact Personal Paper Shredder, Fellows Corporation, Ithaca, NY). This created 68 strips of paper, 0.3 cm wide × 27.9 cm long.

Each PVC tube was positioned in a food bin at an acute angle with respect to vertical so that one end of each tube rested against the wire-mesh front wall of the hanging cage to which the bin holding that tube was attached (see Figure 1). Gravity held the paper strips in the PVC tube and against the wire mesh so that they could be pulled into a cage easily by its occupant.

Before we put paper strips in a PVC tube and placed the tube in a food bin, we sealed the paper strips in a 27 × 28 cm plastic freezer bag (Ziploc Storage Bag, Dow Brands Canada, Paris, Ontario, Canada) with either 0.30 g of Hershey's (Hershey, PA) Pure Cocoa or 0.15 g of McCormick's (Hunt Valley, MD) Ground Cinnamon and shook the bag vigorously to coat the paper strips with flavoring.

Foods

The two foods used in Experiment 1 were prepared by mixing powdered Purina Rodent Laboratory Chow 5001 (Ralston-Purina, St. Louis, MO) with either 1% by weight cinnamon (Diet Cin) or 2% by weight cocoa (Diet Coc). During testing, the foods were presented to subjects in semicircular, stainless steel food cups (10 cm in diameter) that were hung from wire fixtures installed in the end walls of each hanging cage.

Procedure

Experiment 1 was carried out in six steps.

Step 1. To begin the experiment both observer and demonstrator rats were established in their respective home cages, and each demonstrator rat was placed on a 23 hr/day food-deprivation schedule. The demonstrator was allowed to eat powdered chow for 1 hr/day for 2 consecutive days. During this 2-day period and until Step 5 of the *Procedure,* observer rats were left to feed ad lib on their familiar maintenance diet, chow pellets.

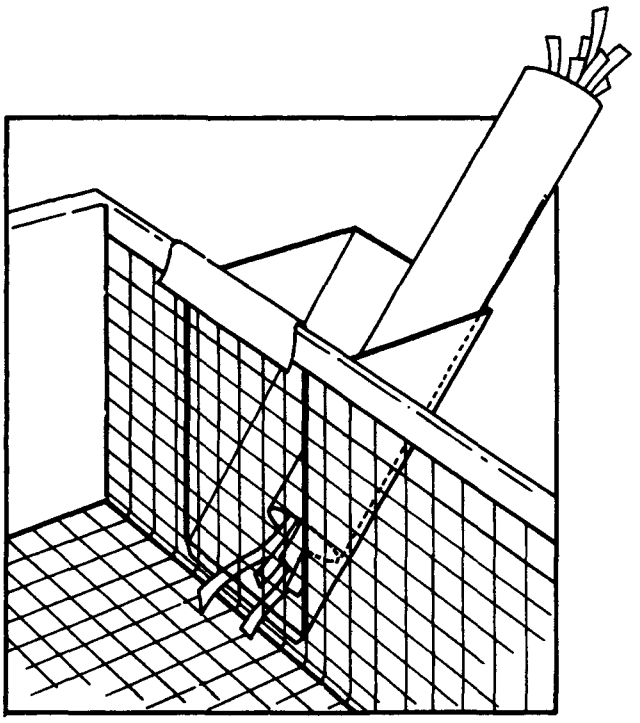

Figure 1. Drawing of a hanging cage and food bin showing the position of a tube with scented paper strips. (One such bin was located at each end of hanging cages used in Experiments 1–4.)

Step 2. After a third 23-hr period of food deprivation, each demonstrator rat was offered, for 1 hr, a weighed food cup of either Diet Cin or Diet Coc.

Step 3. Immediately after removal of the food cup from each demonstrator's cage, an observer rat was introduced into that cage, and the demonstrator and observer were left free to interact for 30 min.

While an observer was interacting with its demonstrator in the demonstrator's home cage, the experimenter weighed PVC tubes together with their contents and then introduced a tube with either cinnamon-scented or cocoa-scented nest material into each of the two bins attached to each observer's home cage. The positions of tubes with cinnamon- and cocoa-scented nest materials were counterbalanced across subjects.

Step 4. Immediately after the 30-min interaction between observer and demonstrator, the observer was returned to its home cage and allowed to choose between cinnamon- and cocoa-scented nest materials for 4 hr.

Step 5. At the end of the 4-hr period for choosing nest materials, the PVC tubing and the paper strips that they contained were removed from the food bins attached to each observer's cage and weighed, and all nest materials and all pellets of Purina chow were removed from inside each observer's cage and discarded. Finally, two weighed food cups, one with Diet Cin and the other with Diet Coc, were placed in each observer's cage, and the observers were then left undisturbed to feed for 20 hr.

Step 6. After the observer's 20-hr feeding period, both food cups were removed from each observer's cage and weighed.

Results and Discussion

The main results of Experiment 1 are presented in Figure 2, which shows the mean percentage of cinnamon-scented nest material and cinnamon-flavored food selected by observers as a function of the foods fed to their respective demonstrators. The observers whose demonstrators had eaten Diet Cin ate a significantly greater percentage of Diet Cin during testing than did observers whose demonstrators had eaten Diet Coc (Mann-Whitney U test, $U = 15$, $p < .001$), and the observers whose demonstrators had eaten Diet Cin did not select a greater percentage of cinnamon-scented nest material than did observers whose demonstrators had eaten Diet Coc ($U = 43$, *ns*). In sum, interaction of observer rats with demonstrator rats fed either cinnamon- or cocoa-flavored chow affected observers' subsequent preferences for cinnamon- and cocoa-flavored foods but not their preferences for cinnamon- or cocoa-scented nest materials.

Experiment 2

One may argue that the demonstrator rats in Experiment 1 influenced their observers' food choices but not their observers' selections of nest materials, because there was greater similarity between scents carried on demonstrators and the smell of foods offered to observers than between scents carried on demonstrators and the smell of nest materials provided for observers. The demonstrators in Experiment 1 had eaten and, therefore, smelled of either Diet Cin or Diet Coc; when the observers selected foods, they chose between Diets Cin and Coc. On the other hand, nest materials provided to observers were scented with only cinnamon or cocoa and did not smell of the chow as well, as had demonstrators.

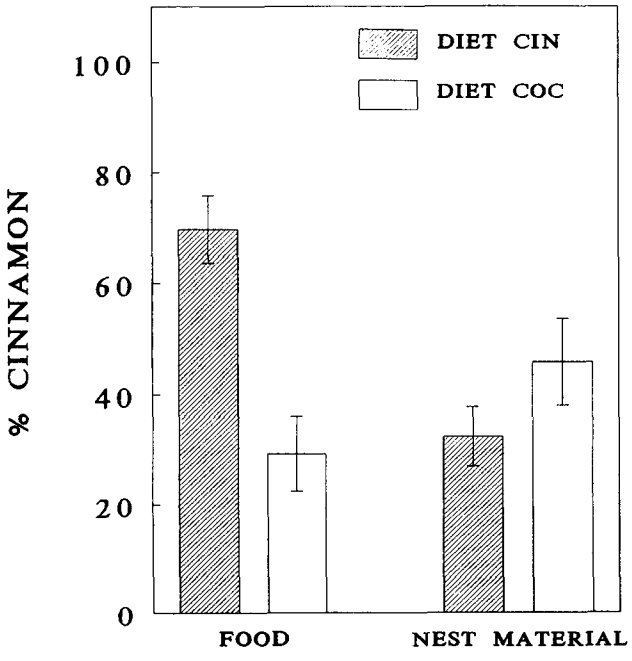

Figure 2. Mean cinnamon-flavored food and cinnamon-scented nest material selected during testing by observer rats whose demonstrators were fed either cinnamon-flavored diet (Diet Cin) or cocoa-flavored diet (Diet Coc). (Experiment 1. Error bars indicate ± 1 SE_M.)

Experiment 2 was undertaken to examine effects of demonstrator rats on both the food and nest-material choices of their observers when the odors carried on demonstrators and nest materials were identical.

The procedure for Experiment 2 was the same as that for Experiment 1 except that, instead of feeding demonstrators rats either Diet Cin or Diet Coc before they interacted with their respective observers, we brushed the heads and shoulders of the demonstrators with either cinnamon or cocoa.

Demonstrator rats need not eat a food to influence the food preferences of observer rats with whom they interact. Observers exhibit enhanced preferences for foods brushed onto their demonstrators' heads and shoulders as robust as the preferences induced by interacting with demonstrators that actually ate a food (Galef et al., 1985; Galef & Stein, 1985).

Method

Subjects

Thirty-two experimentally naive, 42-day-old, female, Long-Evans rats, born in the vivarium of the McMaster University Psychology Department, served as observers in Experiment 2. An additional 32, 49- to 56-day-old, female, Long-Evans rats that had served as observers in other experiments served as demonstrators.

Apparatus

The apparatus used in Experiment 2 was that described in the *Method* for Experiment 1.

Procedure

The procedure for Experiment 2 was similar to that described for Experiment 1 except that the demonstrators were neither food deprived nor fed Diet Cin or Diet Coc before they interacted with their respective observers. Rather, after demonstrators and observers had been left for 2 days to habituate to their respective home cages and just before we placed demonstrators into their respective observers' cages (Step 3 of the *Procedure* for Experiment 1), we used a makeup brush (Clinique Blush Applicator, Clinique Laboratories, Toronto, Ontario, Canada) to apply either cinnamon or cocoa to the head and shoulders of each demonstrator rat. Consequently, when each demonstrator interacted with an observer, the demonstrator bore the clearly discernible scent of either cinnamon or cocoa, rather than the scent of either Diet Cin or Diet Coc.

Steps 4 to 6 of the *Procedure* were carried out as they were in Experiment 1.

Results and Discussion

The main results of Experiment 2 are presented in Figure 3, which shows the mean percentage of cinnamon-scented nest material and cinnamon-flavored food selected by ob-

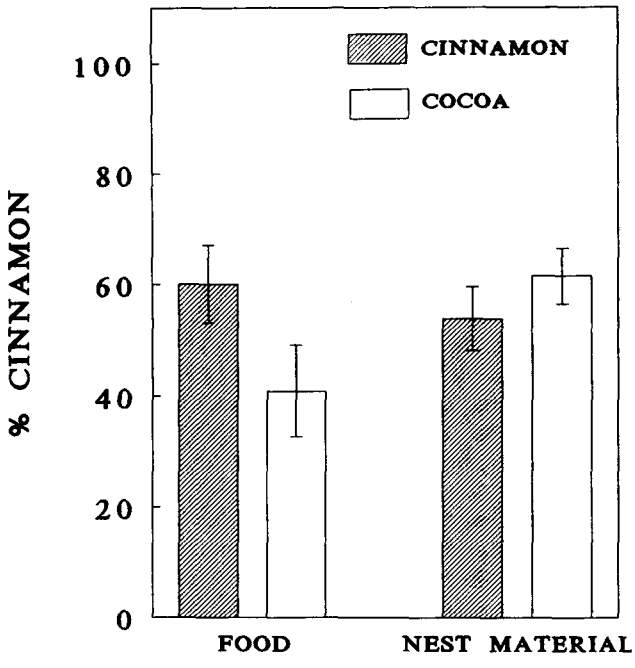

Figure 3. Mean cinnamon-flavored food and cinnamon-scented nest material selected during testing by observer rats whose demonstrators had been brushed with either cinnamon or cocoa. (Experiment 2. Error bars indicate ± 1 SE_M.)

servers as a function of the scents with which their respective demonstrators had been brushed. The observers whose demonstrators had been brushed with cinnamon ate a significantly greater percentage of Diet Cin during testing than did observers whose demonstrators had been brushed with cocoa ($U = 78$, $p < .05$). On the other hand, observers whose demonstrators had been brushed with cinnamon did not exhibit a greater preference for cinnamon-coated nest material than did observers whose demonstrators had been brushed with cocoa ($U = 101$, *ns*).

Thus, we failed to find an effect of scents brushed on demonstrators on the nest-material preferences of observers even though scents borne by demonstrators were identical to the scents carried on nest materials presented to their observers. The observed absence of an effect of demonstrators on their observers' preferences for nest materials is not consistent with the hypothesis that our failure to find such effects in Experiment 1 was due to differences between scents associated with demonstrators and scents placed on nest materials.

Experiment 3

The finding that observer rats do not appear to exhibit preferences for cinnamon- or cocoa-scented nest materials after interacting with demonstrator rats scented with cinnamon or cocoa cannot be used to infer that exposure to a scent cannot affect rats' later preferences for nest materials bearing that scent. It is possible that development of rats' preferences for scented nest materials depends on the context in which rats have previously experienced the scent carried on nest materials.

For example, observer rats develop preferences for Diet Cin or Diet Coc only after experiencing the smell of Diet Cin or Diet Coc on demonstrator rats. To the contrary, allowing observer rats to smell Diet Cin or Diet Coc on surrogate rats constructed of cotton batting had no effect on the later diet preferences of observers (Galef et al., 1985; Galef & Stein, 1985). Enhancement of rats' preferences for scented nest materials may depend in a similar way on exposing rats to scents in an appropriate context.

In Experiment 4, we first exposed experimentally naive rats to nests built by conspecifics with either cinnamon- or cocoa-scented nest materials. We then determined whether experience of a scented nest enhanced a subject's preferences for either nest materials or foods bearing the scent of the nest to which it had been exposed.

It was our expectation that because subjects would not experience cinnamon or cocoa in a social context, exposure to a cinnamon- or cocoa-scented nest would not affect subjects' preferences for cinnamon- or cocoa-scented food (Galef et al., 1985; Galef & Stein, 1985). We had no empirical grounds for predicting whether exposure to scented nests would affect subjects' subsequent preferences for scented nest materials. However, commonsense (or anthropomorphic or cognitive) views of the behavior of rats readily lead to the prediction that if rats determine what to eat by finding out what other rats have eaten, then they may determine what materials to use for building nests by finding out what materials other rats have used for that purpose. On such a hypothesis, one may expect that after a rat has been exposed to a scented nest, it would exhibit an enhanced preference for nest materials, but not for foods, bearing the scent of the nest that it has examined.

Subjects

Twenty-four experimentally naive, 42-day-old, female, Long-Evans rats from the vivarium of the McMaster University Psychology Department served as subjects in Experiment 3. Twenty-four 49- to 56-day-old, female, Long-Evans rats, which had served as subjects in other experiments, built the nests to which subjects were exposed.

Apparatus

Each subject and each nest-building rat were established in individual wire-mesh hanging cages (40 × 18.5 × 24 cm) identical to those used in both Experiments 1 and 2.

Procedure

Experiment 3 was carried out in six steps.

Step 1. To begin Experiment 3, each nest-building rat and each subject rat were placed in individual hanging cages and given 2 days to become familiar with their respective homes.

Step 2. At the end of the 2 days of familiarization, PVC tubes with 15 g of either cinnamon- or cocoa-scented nest material were

placed in both food bins attached to the exterior of each nest builder's cage. The nest builders were then left undisturbed for 4 hr to build as they would.

Step 3. At the end of the 4-hr period of nest building, each nest builder was removed from its cage, and a subject rat was placed in the cage and left there for 30 min to become familiar with the nest the cage contained.

Step 4, 5, and 6. These steps were identical to the corresponding steps described in the *Procedure* for Experiment 1.

Results and Discussion

The main results of Experiment 3 are presented in Figure 4, which shows the mean percentage of cinnamon-scented nest material and of cinnamon-flavored food selected by observers as a function of the scent carried on the nests (M = 9.2 ± 1.3 g) to which subjects were exposed. The subjects that had been exposed to cinnamon-scented nests exhibited neither a significantly greater preference for cinnamon-flavored food (U = 52, *ns*) nor a significantly greater preference for cinnamon-scented nest material (U = 68, *ns*) than did subjects that had been exposed to cocoa-scented nests.

The failure to find effects of exposure to cinnamon- or cocoa-scented nests on subjects' later diet preferences is consistent with the results of previous studies in this laboratory that failed to find enhanced preferences for cinnamon- or cocoa-flavored foods after simple exposure to these foods (Galef et al., 1985; Galef & Stein, 1985). The results of Experiment 3 are inconsistent with the commonsense hypothesis that, if the food choices of rats are influenced by knowledge of the foods that conspecifics are eating, then rats' choices of nest materials are similarly influenced by exposure to materials in nests that other rats have built.

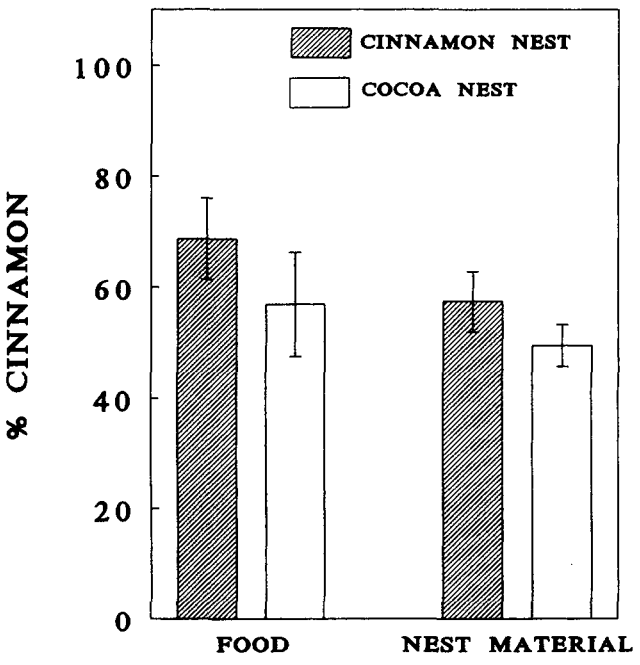

Figure 4. Mean cinnamon-flavored food and cinnamon-scented nest material selected during testing by subjects that had been exposed to either cinnamon- or cocoa-scented nests. (Experiment 3. Error bars indicate ±1 SE_M.)

Experiment 4

The results of Experiments 1, 2, and 3 suggest that the enhanced preference for a scent exhibited by a rat after experience of that scent on a conspecific demonstrator is more likely to be expressed by rats when selecting foods than when engaged in other activities. Of course, the assurance with which such a proposition can be maintained depends in large measure on the number of different situations in which the scent preferences of observer rats have been examined after they interacted with scented demonstrators.

In Experiment 4, we explored the effects of interaction with demonstrator rats that had eaten either Diet Cin or Diet Coc on their observers' relative preferences both for cinnamon- and cocoa-scented nest boxes and for cinnamon- and cocoa-flavored foods. Our goal was to determine whether interaction with scented demonstrators influenced harborage-site preferences of observer rats.

Method

Subjects

Twenty 42-day-old, experimentally naive, female, Long-Evans rats from the vivarium of the McMaster University Psychology Department served as observers in Experiment 4. An additional 20, 49- to 56-day-old, female, Long-Evans rats, which had served as observers in previous experiments, served as demonstrators.

Apparatus

In Experiment 4, we used both the apparatus we had used in Experiments 1, 2, and 3 and 1 × 1 m test enclosures constructed of angle iron, hardware cloth, and galvanized sheet metal. In these enclosures we tested both the food and nest-site preferences of observers. The sheet-metal floor of each test enclosure was covered with wood-chip bedding and contained two painted, wooden nest boxes (24 × 14 × 19 cm), two stainless steel food cups (10 cm in diameter), and two water bottles. Water bottles were located 0.9 m apart at opposite ends of the hardware-cloth front wall of each test enclosure. The food cups were 6 cm apart in the middle of each test enclosure's front wall, and a nest box was placed in each of the two corners at the rear of each test enclosure.

Each nest box had a single entrance (5 × 5 cm) located in the center of the wall facing the food cups, and we attached a glass jar (2.5 cm in diameter) with 6 g of either cinnamon or cocoa to one interior wall of each nest box. To prevent subjects from directly contacting the contents, the mouths of the jars were covered with hardware cloth.

The scent of cinnamon or cocoa was clearly discernible by a human observer who sniffed at the entrance to a nest box.

A closed-circuit television camera and time-lapse videocassette recorder permitted continuous recording of the behavior of observers while they were in enclosures.

Procedure

Experiment 4 was carried out in five steps.

Step 1, 2, and 3. The first three steps of Experiment 4 were identical to the corresponding steps described in the *Procedure* for Experiment 1.

Step 4. At the end of the 30-min period of interaction between a demonstrator rat and its observer, the observer was placed in a test enclosure and left there for 23 hr to choose both between weighed samples of Diet Cin and Diet Coc and between cinnamon- and cocoa-scented nest boxes.

Step 5. At the end of the 23-hr test period, the experimenter weighed food cups to determine the amount of Diet Cin and Diet Coc eaten by each subject and reviewed video tapes to determine how much time each observer had spent in each nest box.

Results and Discussion

The main results of Experiment 4 are presented in Figure 5, which shows the mean percentage of cinnamon-flavored food selected and the mean percentage of total time in nest boxes spent in the cinnamon-scented nest box by observers that interacted with demonstrators fed either Diet Cin or Diet Coc. Although observers that had interacted with demonstrators fed Diet Cin ate significantly more Diet Cin during testing than did observers that had interacted with demonstrators fed Diet Coc ($U = 14$, $p < .001$), observers that had interacted with demonstrators fed Diet Cin did not exhibit a greater preference for cinnamon-scented nest boxes than did observers that interacted with demonstrators fed Diet Coc ($U = 41$, ns).

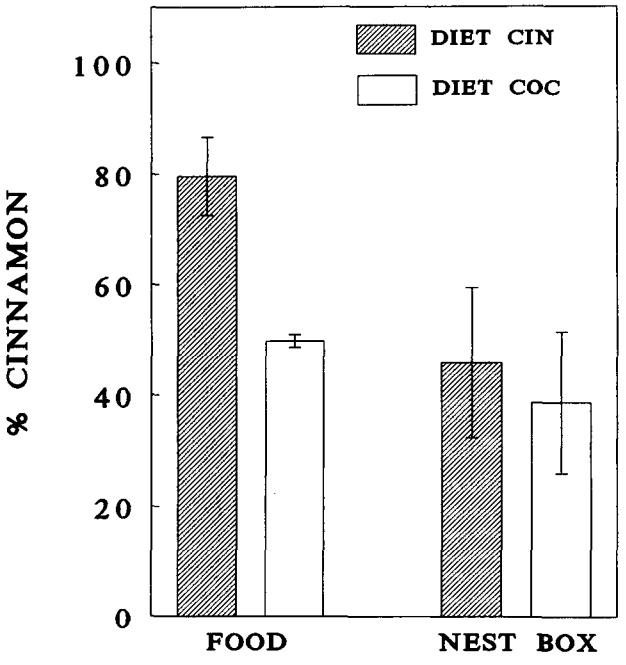

Figure 5. Mean cinnamon-flavored food eaten and mean time spent in cinnamon-scented nest boxes by observer rats whose demonstrators were fed either cinnamon-flavored diet (Diet Cin) or cocoa-flavored diet (Diet Coc). (Experiment 4. Error bars indicate $\pm 1\ SE_M$.)

An examination of the behavior of individual observers reveals that 15 of the 20 observers spent 80% or more of the time in nest boxes in one nest box or the other and that the diet eaten by the demonstrator had no impact on which nest box those 15 observers preferred, $\chi^2(1, N = 15) = 0.15$, *ns.*

Both the bimodal distribution of nest-box preference scores exhibited by observer rats and the failure of demonstrators to affect that distribution contrasted markedly with the diet preference scores of observer rats in the test situation. Interaction with demonstrators fed either Diet Cin or Diet Coc produced a significant shift in the unimodally distributed diet preference scores of their observers.

The results of Experiment 4 are not consistent with the view that exposing observer rats to demonstrator rats fed either Diet Cin or Diet Coc is sufficient to alter the observers' subsequent preferences for cinnamon- or cocoa-scented harborage sites.

Experiment 5

One may argue that, in the case of rats' choice of harborage sites, as in the case of rats' choice of nest materials, attempts to influence observers' nest-box preferences by exposing them to demonstrator rats fed a scented food are inappropriate. Common sense suggests that animals learn where to seek cover as a result of previous experience of harborage sites, not as a result of previous exposure to fed demonstrators. In Experiment 5, we sought to determine whether providing rats with experience of a scented nest site enhanced their future preference for nest sites emitting that scent.

Method

Subjects

Twenty 42-day-old, female, Long-Evans rats born in the vivarium of the McMaster University Psychology Department served as subjects in Experiment 5.

Apparatus

In Experiment 5, we used test enclosures like those used in Experiment 4 except that during Step 1 of the *Procedure,* each test enclosure contained only a single nest box placed in the middle of the enclosure's rear wall and both food cups present in each enclosure contained unadulterated samples of chow.

During Step 2 of the *Procedure,* each subject was placed in a test enclosure arranged identically to those used in Experiment 4.

Procedure

Experiment 5 was conducted in three steps.

Step 1. At 1000 hr on the 1st day of Experiment 5, the subjects were introduced individually into 1 × 1 m enclosures that contained a single nest box. We assigned 10 of the 20 subjects to individual enclosures with a nest box that held a jar with 6 g of

cinnamon and the remainder of subjects to enclosures with a nest box that held a jar with 6 g of cocoa.

Once subjects had been introduced into their respective enclosures, a video camera and videocassette recorder were turned on, and the subjects were left undisturbed for 4 hr.

Step 2. At the conclusion of the 4-hr exposure period, the subject was moved to a new test enclosure, where it was offered a choice for 20 hr between both weighed samples of Diet Cin and Diet Coc and cinnamon- and cocoa-scented nest boxes.

Step 3. At the end of the 20-hr test period, the experimenter both weighed food cups to determine how much of each diet each subject had eaten and reviewed video tapes to determine how much time each observer had spent in each nest box during both Steps 1 and 2.

Results and Discussion

During Step 1, the subjects exposed to cocoa-scented nest boxes spent an average of 2.7 ± 0.2 hr inside the nest box, and the subjects exposed to cinnamon-scented nest boxes spent 2.6 ± 0.4 hr inside the nest box.

The main results of Experiment 5 are presented in Figure 6, which shows both the mean amount of cinnamon-flavored food eaten by subjects and the mean percentage of total time in nest boxes spent in the cinnamon-scented nest box during Step 2. Four hours of exposure to either a cinnamon- or cocoa-scented nest box affected neither the subsequent food preferences ($U = 45$, *ns*) nor the subsequent nest-box preferences ($U = 43$, *ns*) of subjects.

As in Experiment 4, the majority of subjects in Experiment 5 (16 of 20) chose to use one of the two nest boxes for more than 80% of the time they spent in nest boxes, and once again, previous experience of subjects with either cinnamon or cocoa had no effect on the nest box that subjects chose to use, $\chi^2(1, N = 16) = 0.39$, *ns*.

The results of Experiment 5 provide no support for the hypothesis that experience of a scented nest site enhances rats' later preferences for nest sites having that scent.

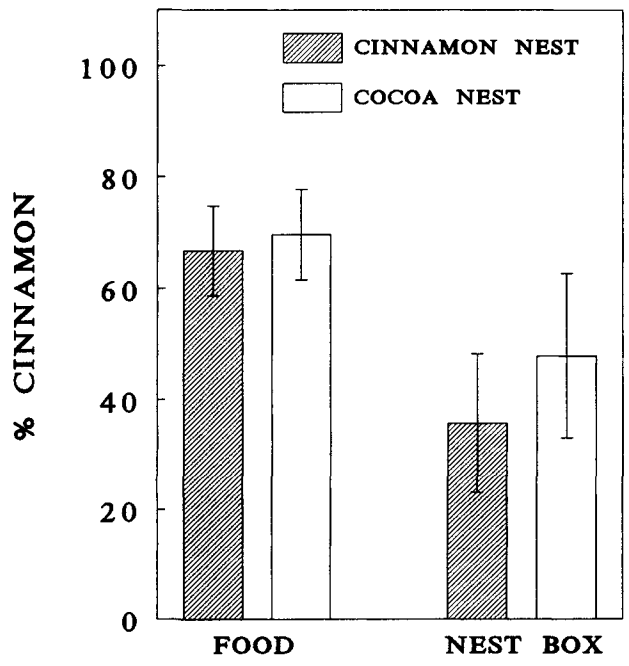

Figure 6. Mean cinnamon-flavored food eaten and mean time spent in cinnamon-scented nest boxes by subjects that had been exposed to either cinnamon- or cocoa-scented nests. (Experiment 5. Error bars indicate ±1 SE_M.)

General Discussion

The results of Experiments 1, 2, and 4 provide evidence consistent with the view that the effect of exposing observer rats to scent-bearing demonstrator rats is to enhance observers' preferences for foods with the scents borne by demonstrators, not to enhance observers' general preferences for objects with those scents. Observer rats exposed to conspecific demonstrators bearing either cinnamon or cocoa (Experiments 1, 2, and 4) exhibited enhanced preferences for diets flavored with cinnamon or cocoa but not for either nest materials (Experiment 1 and 2) or nest boxes (Experiment 4) bearing those scents.

The results of Experiments 3 and 5, in which subjects failed to exhibit changes in their preferences for cinnamon- or cocoa-flavored foods after exposure to cinnamon- or cocoa-scented nests or nest boxes, are consistent with results of previously published experiments (Galef et al., 1985; Galef & Stein, 1985). These experiments also indicate that enhancement of rats' preferences for foods depends on previous experience of those foods in association with conspecifics. The results of Experiments 3 and 5 also indicate, contrary to what common sense might suggest, that exposure to scents either on nest materials or in harborage sites is not sufficient to enhance rats' preferences for those scents when they are again encountered on nest materials or in harborage sites.

Of course, our failures to find effects of exposure to scents on later preferences for those scents (like any other null findings) must be interpreted with caution. It is always possible that under some other set of parametric conditions, effects that we failed to find would be observed. Still, our findings are consistent with the view that susceptibility of rats to social influences on their food preferences is not an epiphenomenon that reflects a general enhancement of rats' preferences for scents experienced in association with conspecifics. If further studies confirm both the positive and null findings that we report in this study, it will be reasonable to conclude that enhancement of observer rats' intake of foods bearing scents the observers had previously experienced in association with conspecifics is a product of processes that support development of preferences for foods rather than development of general olfactory preferences. If so, our findings will not be the first example of changes in the preferences of rats induced by experience that are relatively specific to stimulus characteristics of ingested objects. As has been demonstrated repeatedly in studies of taste-aversion learning, toxicosis-induced reduction in preference is rather specific to stimuli associated with food or drink (Garcia & Ervin, 1968; Garcia, Hankins, & Rusiniak,

1974; see also Galef & Dalrymple, 1981; Rozin & Kalat, 1971; Testa & Ternes, 1977; Wilcoxon, Dragoin, & Kral, 1971). In a similar way, socially induced enhancement of odor preferences in rats may be expressed only in response to odors associated with potential ingesta.

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