Appetite, 1989, *13*, 81–92

Enduring Social Enhancement of Rats' Preferences for the Palatable and the Piquant

BENNETT G. GALEF, JR
McMaster University

In three experiments on the social induction of food preferences in rats, I found: (a) that eight 30-min exposures of a naive "observer" rat to a "demonstrator" rat fed one of two approximately equipalatable diets produced observer preference for the diet fed to its demonstrator that lasted for more than a month, (b) that simple exposure of naive subjects to a diet itself, rather than to a rat that had eaten a diet, was not sufficient to enhance preference for that diet, and (c) that lasting preference for an unpalatable, piquant diet could also be established by exposing naive rats to demonstrators that had eaten the piquant diet, but not by simply exposure to the piquant diet itself. These findings are consistent with the hypothesis proposed by both Birch and Rozin that social-affective contexts are important in establishing stable, learned preferences for foods.

Introduction

People grow to like the foods that they eat. Hence, in humans, feeding experiences can determine which of several inherently palatable foods an individual prefers and can sometimes even produce perverse preferences for inherently unpalatable flavors such as those of coffee or chili pepper. Non-human animals, on the other hand, rarely exhibit lasting, experience-induced enhancement of their preferences for either relatively-palatable or relatively-unpalatable foods (Rozin, 1976, 1984, 1988).

In the present paper, I ask whether the presence of lasting, learned food preferences in humans and their apparent infrequence in other animals reflects a true difference among species in the impact of feeding experience on the development of food preferences. It is at least possible that the absence of demonstrations of lasting, learned food preferences in animals reflects failure to provide them with feeding experiences comparable to those that induce enduring food preferences in humans, rather than an insensitivity to experience in the development of food preferences in non-human animals.

When people eat, eating is often more than simple ingestion of nutrients. Food intake often occurs in a social or cultural context that may determine whether eating a food affects subsequent liking for that food (Rozin, 1984; Rozin & Kennel, 1983). For

Support for this research was provided by grants from the Natural Sciences and Engineering Research Council of Canada and the McMaster University Research Board. I thank Elaine Whiskin, Cecelia Malinski, and Ted Newbigging for their technical assistance and Harvey Weingarten, Matthew Beck, and Mertice Clark for useful critiques of earlier drafts.

Correspondence and reprint requests should be addressed to: Bennett G. Galef, Jr, Department of Psychology, McMaster University, Hamilton, Ontario L8S 4K1, Canada.

0195-6663/89/050081 + 12 $03·00/0

example, Birch *et al.* (1980) reported that lasting (6-week) enhanced preference for snack-foods was induced in preschool children by having adults give the children a food to eat, but not by having the children take the same food from an adult-designated location and eat it. The context within which the children ate the food, rather than the experience of eating the food, determined whether eating the food enhanced preference for it.

Results of recent experiments with rats have demonstrated substantial short-term social enhancement of preferences for foods (Galef, 1986 b; Galef & Wigmore, 1983; Posadas-Andrews & Roper, 1983; Strupp & Levitsky, 1984). When offered a choice between two approximately equipalatable foods (diets A and B), "observer" rats that had each previously interacted with a "demonstrator" rat fed diet A, preferred diet A. Conversely, those observer rats that had each previously interacted with a demonstrator rat fed diet B preferred that diet. Simply eating or smelling diet A or diet B had very limited effects on later preferences for those diets (Galef *et al.*, 1985; Galef & Stein, 1985). Thus, in rats as in children, the context within which food-related cues are experienced can determine whether experience of those cues influences later food preference.

Although effects of exposure to a demonstrator fed some food on its observer's subsequent food selection are often large, their duration has not been examined. Social influences on diet choices of rats might well be transitory and, consequently, quite different from the lasting, learned preferences for foods exhibited by people.

The present series of three experiments was undertaken to determine whether repeated exposure of an observer rat to a conspecific demonstrator that had eaten a food would produce a lasting preference for that food in the observer similar to the lasting, experience-induced food preferences seen in people. I first determined (experiment 1) whether observer rats would exhibit a lasting enhancement of their preferences for whichever of two palatable diets had been eaten by a demonstrator rat with which each observer had interacted on several occasions. In subsequent experiments, I showed, first, that changes in food selection by observers were socially induced, not the result of simple exposure to diets (experiment 2), and, second, (experiment 3) that lasting preference for an unpalatable, piquant food could also be established in Norway rats by social induction, but not by simple exposure to a piquant food.

EXPERIMENT 1

Even if long-term changes in diet preference can be induced in observer rats by interaction with conspecific demonstrators fed some diet, there is no way to know, *a priori*, what durations or frequencies of interaction between demonstrator rats and their respective observers might induce lasting changes in diet preference. I simply guessed that interaction with a demonstrator for 30 min every 2 or 3 days might suffice to produce lasting enhancement of observer preference for a diet eaten by its demonstrator.

Method

Subjects

Twenty-four, 42-day-old, experimentally naive, female, Long–Evans rats, born in the McMaster colony to breeding stock acquired from Charles River Canada (St

Constant, Quebec), served as observers. Before the experiment, observers were maintained in groups of three or four on *ad libitum* Purina Laboratory Rodent Chow and water in a temperature- and humidity-controlled colony room. An additional 24 56-day-old female rats, that had served as observers in previous experiments, served as demonstrators in the present experiment.

During the experiment, each observer was housed alone in a 22 × 24 × 27·5 cm wire-mesh hanging cage with *ad libitum* access to water. Each demonstrator was housed similarly in a room separate from observers.

Procedure

To begin the experiment, each demonstrator was placed on a 23-h food deprivation schedule, eating powdered Purina Laboratory Rodent Chow for 1 h/day. On each day that a demonstrator interacted with its observer, the demonstrator was fed for 1 h either cinnamon-flavored diet (*diet cin*: powdered Purina Laboratory Rodent Chow adulterated 1% by weight with McCormick's "Fancy Ground Cinnamon") or cocoa-flavored diet (*diet coc*: powdered Purina Laboratory Rodent Chow adulterated 2% by weight with Hershey's cocoa).

Each observer had available for 23 h of each of the 32 days of the experiment two food cups, one containing diet cin, the other containing diet coc. During the remaining hour of each day, both food cups were removed from each observer's cage, weighed, refilled, reweighed, and (at the end of the hour) placed back in the cage from which they had been removed.

Eight times during the experiment (at the beginning of days 1, 5, 8, 10, 12, 15, 17 and 19), while food cups were absent from observers' cages, a demonstrator rat, that had been fed either diet cin ($N = 12$) or diet coc ($N = 12$) for the preceding hour, was placed in each observer's cage for 30 min. Each observer interacted with the same demonstrator on all 8 days and that demonstrator was fed the same diet (either diet cin or diet coc) each time for the hour before it was introduced into the cage of its observer.

For the first 24 days of the experiment, the food cup containing diet cin was always in the front of the cages of half the observers and in the back of the cages of the remaining observers. At the beginning of the 25th day of the experiment, the positions of the food cups in each observer's cage were reversed. At the beginning of the 30th day, the positions of food cups were again reversed, so that they were returned to their initial positions in each cage.

Results and Discussion

The main results of experiment 1 are presented in Figure 1 which shows the mean amount of diet cin eaten, as a percentage of total amount ingested, by observers whose demonstrators were fed either diet cin or diet coc.

Days 1–4

Exposure to a demonstrator on day 1 produced a significant enhancement of observers' preferences for their respective demonstrators' diets (day 1: Mann–Whitney, U test, $U = 23$, $p < 0{\cdot}01$) that gradually waned, failing to reach significance on both day 3 ($U = 44$, *NS*) and day 4 ($U = 48$, *NS*) of the experiment.

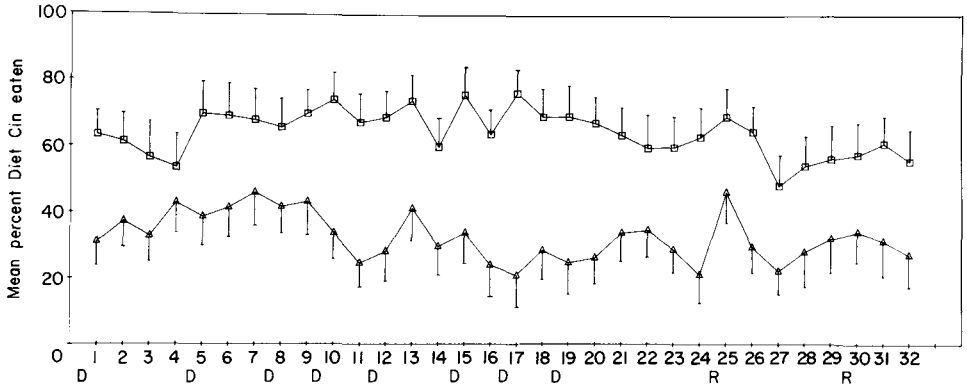

FIGURE 1. Mean amount of cinnamon-flavored diet (diet cin) eaten daily by observers interacting with demonstrators fed either, diet cin, □, cinnamon-flavored diet or cocoa-flavored diet (diet coc, △), as a percentage of total amount ingested. D = 30-min exposure to a demonstrator. R = reversal of position in each cage of foodcups containing diets cin and coc. Flags = ±1 *SEM*.

Days 5–19

A second interaction of each observer with its respective demonstrator, at the beginning of day 5, reinstated observers' preferences for their respective demonstrators' diets during the next 23 h ($U = 34$, $p < 0{\cdot}025$). Twice weekly interactions of demonstrators with their observers maintained observers' preferences for their respective demonstrators' diets to day 19. During the period from day 5–19, observers exhibited a significant ($0{\cdot}001 < p < 0{\cdot}05$) preference for their respective demonstrators' diets on each day but day 7 ($U = 42$, $p = NS$).

Day 19–32

Although no exposures of observers to demonstrators occurred following day 19, observers continued to exhibit a significantly enhanced preference for their respective demonstrators' diets until the experiment was terminated 2 weeks later (day 32: $U = 27$, $p < 0{\cdot}05$). Reversing the position of the food cups in each observer's cage at the beginning of day 25 produced a transient disruption of observers' preferences for their respective demonstrators' diets on day 25, but the same manipulation had no effect on food preferences on day 30, ($U = 33$, $p < 0{\cdot}05$). On each of the last 14 days of the experiment except day 25, observers exhibited a significant ($0{\cdot}001 < p < 0{\cdot}05$) preference for their respective demonstrators' diets.

EXPERIMENT 2

The data of experiment 1 show that food preferences acquired by rats can be maintained for several weeks. These results, however, provide little information as to the conditions sufficient to produce such enduring preference enhancement. Simple, repeated exposure of an observer (Pliner, 1982; Zajonc, 1968) to the odor of diet cin or of diet coc, while the observer was interacting with a demonstrator that had recently eaten diet cin or diet coc might suffice to enhance each observer's subsequent preference for its demonstrator's diet. Alternatively, experience of the odor of diet cin or diet coc

within the context provided by the presence of a demonstrator rat might be necessary for preference enhancement to occur. Indeed, the results of a series of studies (Galef *et al.*, 1985; Galef & Stein, 1985; reviewed in Galef, 1986 a; 1988, in press) indicate that induction, even of short-term changes in diet preference in rats, depends on experience of a diet within the social context provided by the presence of a live conspecific, rather than on simple exposure to the odor or taste of a diet. In the present experiment, I determined whether the enduring, learned flavor preferences, exhibited by observers in experiment 1, would also be exhibited by subjects simply repeatedly exposed to diet cin or diet coc.

Method

Subjects

Forty-eight 42-day-old, female Long–Evans rats born in the McMaster colony served as observers. An additional 48 56-day-old females served as demonstrators.

Procedure

The present experiment was run as two separate studies. The procedure of each was similar to that of experiment 1.

Study 1 (24 observers and 24 demonstrators). On each of the first 5 days of study 1, each observer rat interacted for 30 min with a demonstrator rat previously fed, for 1 h, either diet cin ($N = 12$ observers) or diet coc ($N = 12$ observers). On each of the 17 days of the experiment, each observer was offered a choice between diets cin and coc for 23 h/day. The positions of the food cups in each observer's cage were reversed daily.

Study 2 (24 observers and 24 demonstrators). Observers in study 2 were treated as were observers in study 1 except that, instead of interacting with a demonstrator rat fed either diet cin or diet coc for 30 min on days 1–5 of the study, each observer was presented for 30 min on each of those 5 days with a food cup containing either diet cin or diet coc. Further, on days 8, 9, and 10 of the study, each observer in study 2 interacted with a demonstrator rat previously fed whichever diet (diet cin or diet coc) the observer had not been exposed to for 30 min on each of days 1–5 of the study.

Results

The main results of studies 1 and 2 are presented, respectively, in Figures 2 and 3. Each figure shows the mean amount of diet cin eaten by observers, as a percentage of the total amount of food they ate during the 23-h choice test on each day of the experiment.

Study 1. As can be seen in Figure 2, five 30-min periods of interaction with a demonstrator were sufficient to produce enduring, learned preferences in observers; these changes in diet choice were significant ($0{\cdot}001 < p < 0{\cdot}05$) on every day to completion of the study on day 17.

Study 2. As can be seen in Figure 3, five 30-min exposures to diet cin or diet coc in the absence of a demonstrator had no observable effect on subjects' diet preferences. When, on days 8–10, the same subjects were exposed to demonstrators fed diet cin or diet coc, they developed strong preferences for the food that their respective demonstrators had been fed ($0{\cdot}001 < p < 0{\cdot}01$), indicating that the diet preferences of

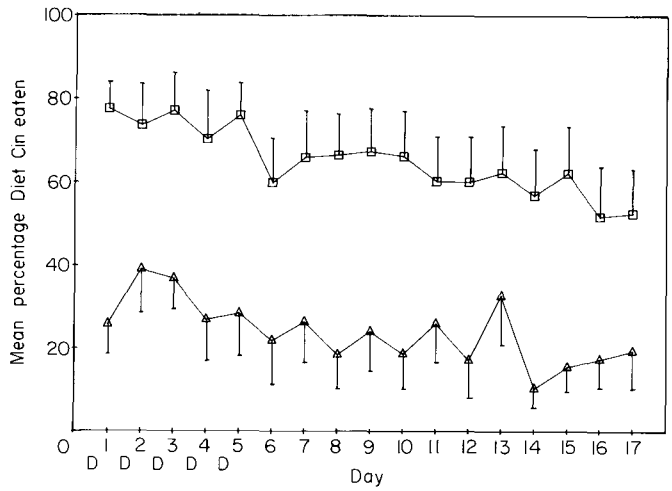

FIGURE 2. Mean amounts of diet cin eaten daily by observers interacting with demonstrators fed either diet coc, △, or diet cin, □, as a percentage of total amount ingested. D = 30-min exposure to a demonstrator. Flags = ±1 *SEM*.

these subjects could be altered, but that such alteration required experience of a diet within the context provided by a demonstrator.

To determine whether exposure to demonstrators fed a diet had a greater influence on the food preferences of their respective observers than did exposure to a diet itself, I compared: (a) the mean percentage of diet cin eaten on days 4 and 5 by observers simply exposed to diet cin ($X = 44{\cdot}1 \pm 5{\cdot}0\%$) with the mean percentage of diet cin eaten on days 9 and 10 by observers interacting with diet-cin-fed demonstrators ($X = 67{\cdot}4 \pm 3{\cdot}5\%$) and (b) the mean percentage of diet coc eaten on days 4 and 5 by observers simply exposed to diet coc ($X = 61{\cdot}3 \pm 6{\cdot}0\%$) with the mean percentage diet coc eaten on days 9 and 10 by observers interacting with diet-coc-fed demonstrators ($X = 79{\cdot}4 \pm 6{\cdot}2\%$). Use of mean intakes for 2 days was necessary to counterbalance the position of the food cups.

The results of Mann–Whitney U tests revealed both that: (a) observers interacting with demonstrators fed diet cin exhibited a greater preference for diet cin than did observers simply fed diet cin ($U = 20$, $p < 0{\cdot}002$) and (*b*) that observers interacting with demonstrators fed diet coc exhibited a greater preference for diet coc than did observers simply fed diet coc ($U = 36$, $p < 0{\cdot}05$).

Further, comparison of the diet preferences of observers in study 1 (Figure 2) with those of observers in study 2 (Figure 3) revealed important differences in the food preferences of subjects in the two studies. During the first 5 days of each study, observers in study 1 (exposed to demonstrators on days 1–5 of the study), exhibited a significant preference for their respective demonstrators' diets on each of days 1–5. Observers in study 2 (simply exposed to a diet on days 1–5 of the study), did not exhibit a preference for the diet to which they had been exposed on any of days 1–5.

Subjects in study 2 ate an average of $0{\cdot}88 \pm 0{\cdot}10$ g/day of diet cin or diet coc on each of the 5 days a food cup was placed in each subject's cage for 30 min. Intake across the 5 days by individual subjects ranged from 1·2 to 9·2 g; those subjects exposed to diet cin ate an average of $4{\cdot}4 \pm 0{\cdot}8$ g, those exposed to diet coc an average of $4{\cdot}6 \pm 0{\cdot}7$ g.

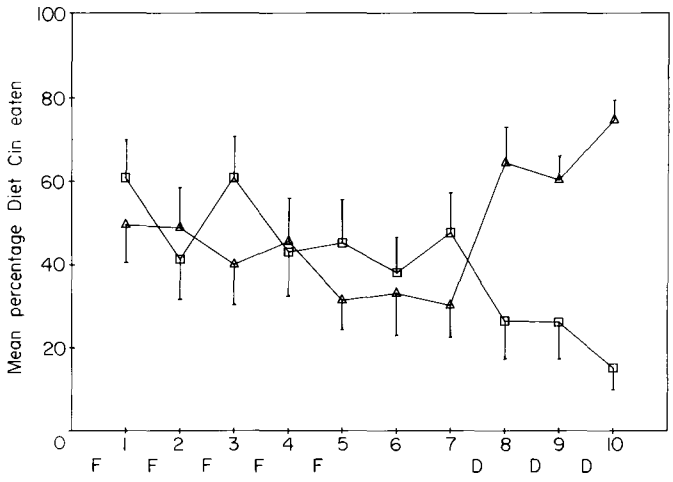

FIGURE 3. Mean amount of diet cin eaten daily by observers as a percentage of total amount ingested by observers: (a) first fed diet cin, □, and then interacting with a demonstrator fed diet coc, △, or (b) first fed diet coc and then interacting with a demonstrator fed diet cin. F = 30-min exposure to a foodcup containing either diet cin or diet coc. D = 30-min exposure to a demonstrator fed either diet cin or diet coc. Flags = ±1 *SEM*.

Discussion

Taken together, the results of the two studies in experiment 2 provide evidence that the changes in observers' diet preferences found in experiment 1 were the result of exposure to diets within a social context, not of exposure to diets *per se*. Half-hour interactions with demonstrators fed cinnamon- or cocoa-flavored diet affected observers' food preferences for at least the following 2 weeks. Comparable exposure of subjects to a diet itself did not affect their food preferences at all.

EXPERIMENT 3

The results of experiments 1 and 2 indicate that exposure, in a social context, to one of two fairly palatable diets can produce a stable enhancement of rats' preferences for the diet experienced in social context. As Rozin (1976) has indicated, one of the relatively unique features of human food choice is the widespread development of preference for congenitally-unpalatable, bitter or irritant substances (see also Galef, 1981).

Such presumably experience-induced, perverse preferences are difficult to elicit in non-human animals. For example, Rozin *et al.* (1979) were unable to induce a preference in rats for chili-pepper-flavored food during 11 months of continuous exposure to it. On the other hand, Rozin & Kennel (1983) induced two chimps to acquire a liking for chili-flavored crackers. Rozin & Kennel (1983, p. 69) attributed their success with chimps to "a close personal relationship (on the part of the chimps) with humans, suggesting an important role for social-affective factors in the reversal of innate aversions".

If, as Rozin & Kennel suggest, social context is important in the development of liking for inherently distasteful flavors, one might expect socially-mediated exposure to irritant foods to be more effective than simple exposure to such foods in inducing preference for them. In the present experiment, I determined whether exposure of rats to an unpalatable piquant in a social context diet would result in a lasting enhancement of the rats' preference for the piquant food.

Method

Subjects

Twelve 42-day-old, experimentally-naive, female Long–Evans rats from the McMaster colony served as observers. Twelve additional, identical rats served as subjects. (For purposes of exposition, I refer to those naive rats interacting with conspecifics as "observers" and to those naive rats interacting with inanimate objects as "subjects".) An additional 12 56-day-old female rats that had served as observers in previous experiments, maintained on a 23 h/day deprivation schedule, served as demonstrators in the present experiment.

Procedure

Experimental group. Observers ($N = 12$) were offered a choice between diet coc and a piquant diet, diet cay (Purina Laboratory Rodent Chow adulterated 0·5% by weight with Donna Brand Hot Cayenne Pepper; Donna Importing Co., Mississauga, Ontario) for 23 h/day for 25 days. Before diet coc and diet cay were presented to observers on days 1–5 and days 8–9 of the experiment, each observer interacted for 30 min with a demonstrator that had just eaten diet cay for 1 h.

The cayenne-pepper-flavored diet I used (diet cay) was selected after pretesting several concentrations of cayenne pepper to find a mildly-aversive diet. Twelve naive rats offered a choice between diet cay (0·5% cayenne pepper) and diet coc for 24 h ate $16{\cdot}7 \pm 7{\cdot}1\%$ diet cay. Thus, diet cay was probably considerably less aversive than the piquant diet (15% cayenne pepper) used with rats by Rozin *et al.* (1979). I have no reason to believe that a socially-enhanced preference could be induced in rats for a piquant diet as inherently unpalatable as that used by Rozin *et al.* in their studies.

Control group. Subjects ($N = 12$) in the control group were treated identically to observers in the experimental group except that on each of days 1–5 and 8–9 of the experiment, instead of putting a demonstrator that had eaten diet cay into each subject's cage for 30 min, I placed a food bowl containing diet cay in each subject's cage for 30 min.

Results

The main results of experiment 3 are presented in Figure 4 which shows the mean amount of diet cay, as a percentage of total amount consumed, eaten by observers and subjects. Observers in the experimental group ate a significantly greater percentage of diet cay ($0{\cdot}05 > p > 0{\cdot}01$) than did subjects in the control group on each day of the experiment except days 8, 24, and 25. On no day of the experiment did subjects in the control group eat a significantly greater mean percentage of diet cay than had the 12 naive rats used to establish the relative palatabilities of diet cay and diet coc.

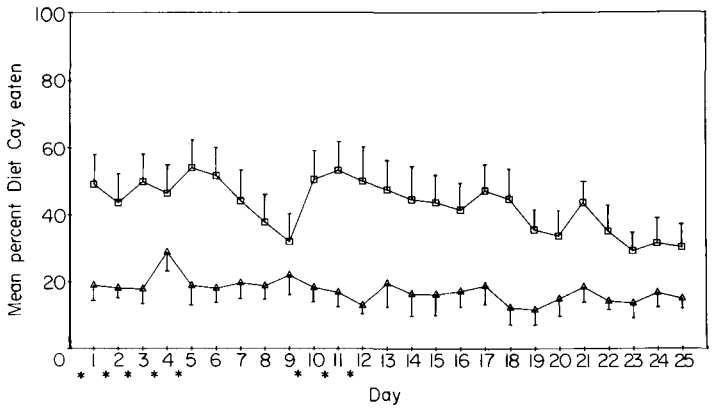

FIGURE 4. Mean amount of a piquant, cayenne-pepper-flavored diet (diet cay) eaten daily by subjects given diet cay to eat for 30-min/day (control, △) or observers interacting for 30-min/day with demonstrators previously fed diet cay (experimental, □), as a percentage of total amount eaten. Asterisk = subjects fed diet cay or observers interacted with a demonstrator fed diet cay for 30 min. Flags = ±1 *SEM*.

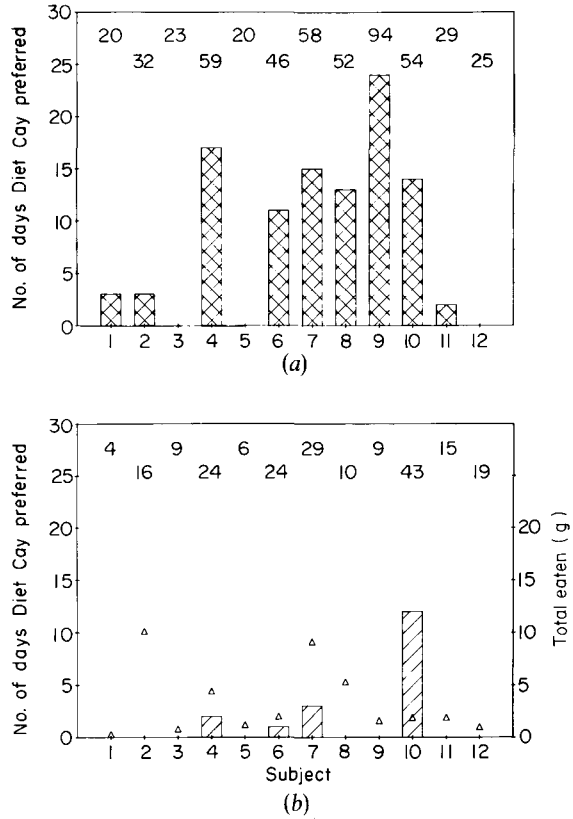

FIGURE 5. Number of days (out of 25) each subject in (a) experimental and (b) control conditions ate more diet cay than diet coc. Numbers above each bar = the mean percentage diet cay eaten by an observer across the 25, 23-h periods of diet choice. Triangles in lower panel = the total amount of diet cay eaten by each control subject during the eight, 30-min periods it was presented with a foodcup containing diet cay.

Figure 5 shows the number of days on which each observer in the experimental group and each subject in the control group ate more diet cay than diet coc, i.e. the number of days on which each observer or subject preferred diet cay. As can be seen in Figure 5, six of 12 observers, but only one of 12 subjects frequently preferred piquant food (Fisher Test of Exact Probability, $p < 0{\cdot}05$).

Failure of subjects in the control group to exhibit a preference for diet cay cannot be explained by their failure to sample diet cay during the eight, 30-min periods during which they were exposed to diet cay. As can also be seen in Figure 5, subjects in the control group ate from 0·2 to 10·0 g of diet cay during their eight, 30-min periods of exposure to diet cay ($X = 0{\cdot}4 \pm 0{\cdot}2$ g/day).

Discussion

Exposure of naive observer rats to demonstrator rats fed a piquant diet produced a preference for the piquant diet in many observers. Exposure to the piquant diet itself did not have a similar effect. Thus, effects of demonstrators fed piquant diet on subsequent ingestion of the piquant diet by their observers cannot be attributed to the effects of simple exposure to piquant diet. Rather, enhanced preference of observers for piquant food depended on observers' experience of piquant-diet-related cues within a social context provided by their demonstrators (Galef, 1986, 1988, in press; Galef *et al.*, 1985; Galef & Stein, 1985). Although, as one might expect, socially-induced preference for an inherently unpalatable, piquant food was less robust than socially-induced preference for one of two relatively palatable foods, social induction was effective in increasing intake of piquant food for weeks.

The observation that not all observers in the experimental group were affected in their choice of piquant food by interaction with their respective demonstrators is consistent with results of previous experiments in which social determinants have been pitted against non-social determinants of diet choice. In all such cases, some observers seem susceptible to social influence in their diet selection, some do not (Galef, 1986b). The reasons for such individual differences in response to social influence on diet choice remain obscure.

General Discussion

Previous experiments have shown that interaction of a naive observer rat with a conspecific demonstrator fed a diet can produce an increase in the observer's preference for the diet fed to its demonstrator that lasts a few days. The results of the present experiments indicate: (a) that interaction with demonstrators can affect the diet preferences of their observers for weeks, and (b) that long-term preferences for unpleasant-tasting, piquant foods, as well as for palatable foods, can be enhanced by experience of a diet in a social context.

The present data are consistent with both Rozin's (1988), Rozin & Kennel's (1983) and Birch's (1987) suggestions that the social-affective context within which a food is experienced can determine the efficacy of exposure to a food in enhancing subsequent preference for that food. The results are not consistent with Rozin & Kennel's (1983) implicit assumption that only social interactions with humans in feeding situations provide social-affective contexts adequate to enhance preference for foods.

Rats, like people, can be influenced in their choice of both palatable and piquant foods by interaction with conspecifics that have eaten those foods. Previously reported failures to induce enduring preferences in animals for congenitally distasteful foods (Capretta & Rawls, 1974; Rozin *et al.*, 1979; Warren & Pfaffmann, 1959) may have resulted from failure to provide appropriate social contexts for lasting enhancement of food preferences.

References

Birch, L. L. (1987) The acquisition of food acceptance patterns in children. In R. Boakes, D. Popplewell & M. Burton (Eds), *Eating habits.* Pp. 107–130. Chichester, England: Wiley.

Birch, L. L., Zimmerman, S. I. & Hind, H. (1980) The influence of social-affective context on the formation of children's food preferences. *Child Development, 51,* 856–861.

Capretta, P. J. & Rawls, L. H., III (1974) Establishment of flavor preference in rats. Importance of nursing and weaning experience. *Journal of Comparative and Physiological Psychology, 86,* 670–673.

Galef, B. G., Jr (1981) Development of flavor preference in man and animals: The role of social and nonsocial factors. In R. N. Aslin, J. R. Alberts & M. R. Peterson (Eds), *Development of perception.* Pp. 411–431. New York: Academic Press.

Galef, B. G., Jr (1986 a) Olfactory communication among rats: Information concerning distant diets. In D. Duvall, F. Müller-Schwarze & R. M. Silverstein (Eds), *Chemical signals in vertebrates* (Vol. 4). Pp. 487–505. New York: Plenum Press.

Galef, B. G., Jr (1986 b) Social interaction modifies learned aversions, sodium appetite, and both palatability and handling-time induced dietary preference in rats. *Journal of Comparative Psychology, 100,* 432–439.

Galef, B. G., Jr (1988) Communication of information concerning distant diets in a social, central-place foraging species: *Rattus norvegicus.* In T. R. Zentall & B. G. Galef, Jr (Eds), *Social learning: psychological and biological perspectives.* Pp. 119–140. Hillsdale, NJ: Erlbaum.

Galef, B. G., Jr An adaptationist perspective on social learning, social feeding, and social foraging in Norway rats. In D. Dewsbury (Ed.), *Contemporary issues in comparative psychology,* Sunderland, MA: Sinauer. (In press).

Galef, B. G., Jr, Kennett, D. J. & Stein, M. (1985) Demonstrator influence on observer diet preference: effects of simple exposure and the presence of a demonstrator. *Animal Learning and Behavior, 13,* 15–20.

Galef, B. G., Jr & Stein, M. (1985) Demonstrator influence on observer diet preference: analysis of critical social interactions and olfactory signals. *Animal Learning and Behavior, 13,* 31–38.

Galef, B. G., Jr & Wigmore, S. W. (1983) Transfer of information concerning distant foods: A laboratory test of the "information-centre" hypothesis. *Animal Behavior, 31,* 748–758.

Pliner, P. (1982) The effects of mere exposure on liking for edible substances. *Appetite, 3,* 283–290.

Posadas-Andrews, A. & Roper, T. J. (1983) Social transmission of food preferences in adult rats. *Animal Behaviour, 31,* 265–271.

Rozin, P. (1976) The significance of learning mechanisms in food selection: Some biology, psychology and sociology of science. In L. M. Barker, M. Best & M. Domjan (Eds), *Learning mechanisms in food selection.* Pp. 557–592. Waco, TX: Baylor University Press.

Rozin, P. (1984) The acquisition of food habits and preferences. In J. D. Matarazzo, S. M. Weiss, J. A. Herd, N. E. Miller & S. M. Weiss (Eds), *Behavioral health: a handbook of health enhancement and disease prevention.* Pp. 590–607. New York: Wiley.

Rozin, P. (1988) Social learning about food by humans. In T. R. Zentall & B. G. Galef, Jr (Eds), *Social learning: psychological and biological perspectives.* Pp. 165–187. Hillsdale, NJ: Erlbaum.

Rozin, P., Gruss, L. & Berk, G. (1979) Reversal of innate aversions: Attempts to induce a preference for chili peppers in rats. *Journal of Comparative and Physiological Psychology, 93,* 1001–1014.

Rozin, P. & Kennel, K. (1983) Acquired preference for piquant foods by chimpanzees. *Appetite, 4,* 69–77.

Strupp, B. J. & Levitsky, D. A. (1984) Social transmission of food preferences in adult hooded rats (*Rattus norvegicus*). *Journal of Comparative Psychology, 98*, 257–266.

Warren, R. P. & Pfaffmann, C. (1959) Early experience and taste aversion. *Journal of Comparative and Physiological Psychology, 52*, 263–266.

Zajonc, R. B. (1968) Attitudinal effects of mere exposure. *Journal of Personality and Social Psychology, 9*, 1–27.

Received 30 October 1987, revision 30 October 1988