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ScienceDirect
Behavioural Processes 74 (2007) 104–106
BEHAVIOURAL PROCESSES
www.elsevier.com/locate/behavproc

Short report

Dogs acquire food preferences from interacting with recently fed conspecifics

Gwen Lupfer-Johnson *, Julie Ross

University of Alaska Anchorage, United States

Received 7 July 2006; received in revised form 14 August 2006; accepted 13 September 2006

Abstract

Social transmission of food preferences has been documented in many species including humans, rodents, and birds. In the current experiment, 12 pairs of domestic dogs (*Canis familiaris*) were utilized. Within each pair, one dog (the demonstrator) was fed dry dog food flavored with either basil or thyme. The second dog (the observer) interacted with one demonstrator for 10 min before being given an equal amount of both flavored foods. Observers exhibited a significant preference for the flavored diet consumed by their demonstrators, indicating that dogs, like rats, prefer foods smelled on a conspecific's breath.

Keywords: Domestic dogs; Social influence; Social transmission of food preferences; Social learning

1. Introduction

1.1. Dogs acquire food preferences from interacting with recently fed conspecifics

The list of species capable of learning from conspecifics what to eat, where to find it, or how to get it is already quite long and continues to grow. To name a few, human children (Birch, 1980), Mongolian gerbils (*Meriones unguiculatus*; Valsecchi et al., 1996), dwarf hamsters (*Phodopus campbelli*; Lupfer et al., 2003), and red-winged blackbirds (*Agelaius phoeniceus*; Mason et al., 1984) all learn to prefer foods eaten by conspecifics. Social learning about foods is perhaps best understood in Norway rats (*Rattus norvegicus*), thanks largely to the work of Galef and colleagues (for a recent review, see Galef, 2005). Norway rats develop a strong preference for foods smelled on another rat's breath and are able to determine what foods are currently available based on what a conspecific has eaten. (Galef and Wigmore, 1983).

It has long been recognized that social behaviors are part of the canine feeding system. Early evidence for this notion comes from Pavlov's laboratory, when an experimenter there freed a dog from its harness before presenting the metronome conditioned stimulus for food. The metronome CS elicited barking, tail wagging, and, "...the whole system of behavior patterns serving, in a number of Canidae, to beg food from a conspecific" (Lorenz, 1969, p. 47). Although this result came from a single subject, the fact that a CS for food triggered social behaviors suggests that the feeding behavior system of domestic dogs includes a social component.

Socializing when searching for food is clearly advantageous for dogs; young puppies can learn by observing one another how to obtain food (Adler and Adler, 1977), and adult dogs learned a detour task to food more easily after watching a human demonstrator (Pongrácz et al., 2001). However, the separate issue of whether dogs learn what to eat from one another has not been investigated.

The current experiment was conducted to address this question specifically, using a methodology similar to what has been successfully employed in the past with multiple rodent species. Subject dogs were allowed to socialize with demonstrator dogs that had recently been fed one of two flavored foods. Subjects were then given the opportunity to choose between the flavored foods. It was hypothesized that dogs would prefer the flavor eaten by their demonstrators.

* Corresponding author at: Department of Psychology, Social Sciences Building Room 214B, University of Alaska Anchorage, 3211 Providence Drive, Anchorage, AL 99508-4614, United States. Tel.: +1 907 786 1722; fax: +1 907 786 4898.

E-mail address: afgjl@uaa.alaska.edu (G. Lupfer-Johnson).

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doi:10.1016/j.beproc.2006.09.006

2. Method

2.1. Subjects

Twenty-two domestic dogs were used in the current experiment, with one dog serving as the demonstrator on three separate occasions for a total of 12 demonstrator–observer pairs. All other demonstrators and all observers were utilized only once.

Eighteen of these dogs were being housed at a boarding facility in Anchorage, Alaska; the remaining four dogs belonged to faculty or students of UAA. The subjects ranged in size from approximately 10 pounds for a Chihuahua mix to 90 pounds for a male Rottweiler, and in age from 10 months to 10 years. In 10 of the demonstrator–observer pairs, the dogs were already familiar with one another. In the remaining two pairs, the dogs met for the first time on the day of testing.

2.2. Materials

Flavored dog foods were prepared by adding 2% by weight of either dried basil or thyme leaves to Iams® dog food.

2.3. Procedure

Testing took place within one hour of each subject's normal daily feeding time, so that no food deprivation was necessary. Demonstrator dogs were taken to a separate room and allowed to eat one flavored food for 20 min. Small dogs were given 100 g of dog food, and larger dogs received 200 g. At the end of 20 min, food dishes were weighed to ensure that each demonstrator had consumed at least 20 g of flavored food before interacting with an observer. With one exception, dogs were assigned to pairs based on size, so that demonstrators and their observers were of similar size. Pairs were allowed to socialize for 10 min, during which time they were either observed or videotaped to ensure social interaction, minimally including the observer sniffing at the demonstrator's mouth, took place. Four Shih Tzu dogs, not included in the 22 subjects described above, were discarded from the experiment due to a complete lack of social interaction.

Following social investigation of their demonstrators, observers were offered an equal amount (100 g for small dogs; 200 g for larger dogs) of both flavored foods to eat. Twenty minutes later, the amount of each flavored diet remaining was measured using a Satorius® GE812 digital scale.

3. Results and discussion

For each subject, the percentage of food eaten that was its demonstrator's flavor was calculated by dividing the amount of demonstrator's flavor eaten by the total amount of both foods eaten. The mean percentage demonstrator's food eaten was 68.16, with a standard error of 6.99. Fig. 1 displays this mean as well as the individual data points for all thyme and basil observers.

A one-way analysis of variance was then conducted on the percentage of basil-flavored food consumed by subjects that interacted with basil or thyme demonstrators. Dogs with basil demonstrators ate significantly more basil-flavored food than did subjects with thyme demonstrators $F(1,10) = 6.03$, $p = 0.03$.

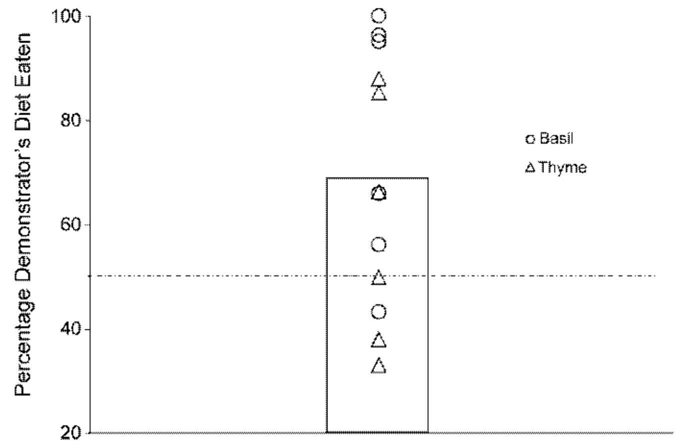

Fig. 1. Percentages of basil- or thyme-flavored foods consumed by observers interacting with basil or thyme demonstrators. The rectangle indicates the mean percentage demonstrator's diet consumed, and the circles and triangles designate individual data points. The dotted line represents 50%, or no preference.

These results indicate that domestic dogs, like many other species, learn to prefer foods that conspecifics have eaten. The interactions that occurred between demonstrators and observers suggest that this social influence occurs by means of olfactory cues found in the demonstrators' mouths. All observer subjects exhibited some sniffing at their demonstrators' heads; some subjects, however, engaged in more extensive investigation of their demonstrators' mouths, licking at the demonstrators' teeth and gums in a manner similar to the way rats examine the mouth of a recently fed conspecific (Timberlake, 1983). Future experiments could explore the possibility that a compound found in canine breath or saliva might be involved in the social transmission of a food preference, as is the case with Norway rats (Galef et al., 1988).

The function of this type of social influence in domestic dogs should also be investigated. It is possible that social learning of food preferences was beneficial for dogs during their evolutionary history because it enabled them to search for foods that were currently available and safe. Unlike wolves, which are carnivorous, early dogs appear to have relied on trash found in human villages for food (Coppinger and Coppinger, 2001). Primitive dogs, then, may have been omnivores, having to select from a wide variety of foods present at unpredictable times. Social cues providing information about which of those foods was edible and/or currently available would have been beneficial for them. On the other hand, these same cues would be less useful for true wolves, who hunt live prey rather than relying on humans for food; one might predict that wolves would not acquire a food preference socially the way the dogs in the current experiment did.

Finally, social learning of food preferences in domestic dogs presents another opportunity to examine heterospecific social influence. As mentioned previously, dogs learn routes to food from watching human demonstrators (Pongrácz et al., 2001), and readily follow human pointing gestures to food (Soproni et al., 2002). Both of these findings are consistent with the view that domestic dogs evolved feeding on human refuse (Coppinger and Coppinger, 2001), and it seems likely that they would acquire food preferences from humans as well. If so, this would be another similarity between dogs and rats; humans, like rats, exhale carbon disulfide, and rats can acquire flavor preferences from smelling a human's breath (Galef, 2005). As both dogs and rats may have domesticated themselves by adapting to feed in early human villages (Coppinger and Coppinger, 2001), both species may readily learn about foods from people.

Acknowledgements

Funding for this project was provided by a Faculty Development Grant from the University of Alaska Anchorage. The authors would also like to thank the owners, managers, and staff of The Dog Wash Resort in Anchorage, Alaska, for allowing us collect data at their facility. In addition, we are grateful to two anonymous reviewers for their thoughtful comments on a previous draft.

References

Adler, L.L., Adler, H.E., 1977. Ontogeny of observational learning in the dog (*Canis familiaris*). Dev. Psychobiol. 10, 267–271.

Birch, L.L., 1980. Effects of peer models' food choices and eating behaviors on preschoolers' food preferences. Child Dev. 51, 489–496.

Coppinger, R., Coppinger, L., 2001. Wolves evolve into dogs. In: Coppinger, R., Coppinger, L. (Eds.), Dogs: A Startling New Understanding of Canine Origin, Behavior and Evolution. Scribner, New York, NY, pp. 39–67.

Galef Jr., B.G., 2005. Social learning. In: Whishaw, I., Kolb, B. (Eds.), The Behavior of the Laboratory Rat: A Handbook with Tests. Oxford University Press, New York, NY, USA, pp. 363–370.

Galef Jr., B.G., Mason, J.R., Pretti, G., Bean, N.J., 1988. Carbon disulfide: a semiochemical mediating socially induced diet choice in rats. Physiol. Behav. 42, 119–124.

Galef Jr., B.G., Wigmore, S.W., 1983. Transfer of information concerning distant foods: a laboratory investigation of the 'information-center hypothesis'. Anim. Behav. 31, 748–758.

Lorenz, K.Z., 1969. Innate bases of learning. In: Pribram, K. (Ed.), On the Biology of Learning. Hartcourt, Brace, and World, New York, pp. 13–93.

Lupfer, G., Frieman, J., Coonfield, D.L., 2003. Social transmission of flavor preferences in social and non-social hamsters. J. Comp. Psychol. 117, 449–455.

Mason, J.R., Artz, A.H., Reidinger, R.F., 1984. Comparative assessment of food preferences and aversions acquired by blackbirds via observational learning. Auk 101, 796–803.

Pongrácz, P., Miklósi, A., Kubinyi, E., Gurobi, K., Topál, J., Csányi, V., 2001. Social learning in dogs: the effect of a human demonstrator on the performance of dogs in a detour task. Anim. Behav. 62, 1109–1117.

Soproni, K., Miklósi, A., Topál, J., Csányi, V., 2002. Dogs' (*Canis familiaris*) responsiveness to human pointing gestures. J. Comp. Psychol. 116, 27–34.

Timberlake, W., 1983. The functional organization of appetitive behavior. In: Zeiler, M.D., Harzem, P. (Eds.), Advances in Analysis of Behavior: Biological Factors in Learning, vol. 3. John Wiley & Sons, New York, NY.

Valsecchi, P., Choleris, E., Moles, A., Guo, C., 1996. Kinship and familiarity as factors affecting social transfer of food preferences in adult Mongolian gerbils (*Merione unguiculatus*). J. Comp. Psychol. 110, 243–251.