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Increased reliance on socially acquired information while foraging in risky situations?

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We undertook three experiments to investigate the hypothesis that as the potential costs of individual learning increase, reliance on social learning also increases. We found no effect of indirect cues of predation risk on use of previously acquired social information by Norway rats, *Rattus norvegicus*, choosing between unfamiliar foods (experiment 1). We also found decreased (not increased) use of socially acquired information by rats choosing between unfamiliar foods when exposed to direct cues of predation risk (experiment 2). Furthermore, experiences of gastrointestinal upset following ingestion of unfamiliar foods (intended to act as a cue to the presence of toxic potential foods) failed to increase rats' use of social information when choosing between additional unfamiliar foods (experiment 3). The results of our experiments thus failed to confirm predictions of several formal models of the effects of costs of individual assessment of alternatives on use of socially acquired information.

Formal models of the conditions that should lead decision makers to depend on social rather than individual learning consistently predict that reliance on socially acquired information should increase when potential costs of individual assessment rise (Boyd & Richerson 1985, 1988; Feldman et al. 1996; Laland 2004; Kendal et al. 2005). In particular, when risk of predation is high, costs of individual assessment of potential mates (e.g. Lima & Dill 1990; Reynolds & Gross 1990; Sih 1994), or foods, should increase dependence on previously acquired social information.

To assess the nutritional value of unfamiliar foods an animal must repeatedly sample each available alternative (Rozin 1969; Rozin & Schulkin 1990). Repeated sampling of alternative foods requires an increase in time spent searching for and eating foods away from safe harbourage sites. Consequently, when choosing between unfamiliar foods, foragers facing enhanced risk of predation might be expected to reduce potential costs of individual assessment by relying more heavily on previously acquired social information than foragers not exposed to predation risk.

Cues indicative of predation risk can be either direct, as when an individual detects a predator or cues directly associated with the presence of a predator (e.g. Powell & Banks 2004), or indirect, indicating that a predator's attack is likely to be successful if it occurs, for example, when distance to shelter is great and concealment is impossible (e.g. Hughes & Ward 1993; Genaro & Schmidek 2000; Arcis & Desor 2003; Orrock et al. 2004). Numerous empirical studies have examined effects of both indirect and direct cues of predation risk on foraging patterns (e.g. Herman & Valone 2000; Pusenius & Ostfeld 2002; Arcis & Desor 2003). Such studies have generally found that animals under threat of predation forage more frequently under or near cover, sometimes increasing (Lima & Valone 1986; Leaver & Daly 2003) and sometimes decreasing (e.g. Cerri & Fraser 1983; Metcalfe et al. 1987; Ibraham & Huntingford 1989) their choosiness or selectivity with respect to potential food items. However, we know of no experiments investigating the focus of interest here, the effect of predation risk on dependence on socially acquired information when foraging.

Results of studies both in our laboratory and elsewhere have shown repeatedly that after a naïve Norway rat, *Rattus norvegicus* (an observer) interacts with a conspecific that has recently eaten a distinctively flavoured food (a demonstrator), the observer shows an enhanced preference for whatever food its demonstrator ate (for reviews, see Galef 1988, 1996, 2001). In the three experiments reported here, we examined effects of indirect (experiment 1) and direct (experiment 2) cues of predation risk as well as risk of ingesting toxins (experiment 3) on rats' use of previously acquired social information when choosing

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between two foods that they had not previously eaten. We expected, as predicted by the formal models referenced above (Boyd & Richerson 1985, 1988; Feldman et al. 1996; Laland 2004; Kendal et al. 2005), as well as by common sense, that increasing the potential cost to observers of individually assessing alternative unfamiliar foods by increasing predation risk would increase observers' reliance on information previously acquired from demonstrators in deciding what to eat.

EXPERIMENT 1: INDIRECT PREDATION RISK

In experiment 1, we looked for effects of both distance from shelter and opportunity for concealment on Norway rats' use of previously acquired social information when choosing between two unfamiliar foods. If indirect predation risk affects dependence on social learning, then rats choosing between two unfamiliar foods when relatively far from a harbourage site and in the open should be more reliant on previously acquired social information concerning one of the two foods available to them than should rats feeding close to a harbourage site and under cover.

Methods

Subjects

Forty-four, 7-week-old male, female Long–Evans rats acquired from Charles River Canada (St Constant, Quebec) when 7 weeks of age served as observers. An additional 44 female Long–Evans rats that had served as observers in previous experiments served here as demonstrators.

To examine effects of indirect cues of predation risk on reliance on socially acquired information, we systematically varied: (1) the distance from the nestbox to the two foods available to each observer and (2) the presence or absence of cover at the feeding site. Consequently, each observer was randomly assigned to one of four conditions: (1) near-open ($N = 10$), (2) near-covered ($N = 10$), (3) far-open ($N = 12$) and (4) far-covered ($N = 12$).

Diets

We composed two roughly equipalatable diets (diet cin and diet coc) by adding either 1.0 g McCormick's Ground Cinnamon (McCormick Canada, London, Ontario), or 2.0 g of Hershey's Pure Cocoa (Hershey Canada Inc., Mississauga, Ontario), respectively, to sufficient Teklad Rodent Diet (W) 8640 (diet 8640: Harlan-Teklad, Madison, Wisconsin, U.S.A.) to equal 100 g. Similar diets (differing only in whether they have been flavoured with cinnamon or cocoa) have been used successfully in numerous previous studies of social influence on food choice in rats both in our laboratory and elsewhere.

Apparatus

Preference induction. During the preference-induction stage of the experiment, demonstrators and observers lived in individual stainless-steel hanging cages measuring $21 \times 24 \times 27$ cm. We presented food to subjects in semicircular stainless-steel food cups (10-cm diameter, 5 cm deep) that we attached to one wall of the cage and, to prevent spillage, filled to less than half their depth.

Testing of observers. We tested each observer in a floor enclosure constructed of angle iron and hardware cloth, measuring $1 \times 2 \times 0.3$ m. The galvanized sheet metal floor of each enclosure was covered to a depth of 2 cm with wood shavings, and each enclosure contained a wooden nestbox, measuring $16 \times 16 \times 24$ cm, and two 10-cm diameter, 5-cm-high Pyrex bowls, one containing diet cin and the other diet coc.

We placed the food bowls of observers assigned to eat under cover inside a three-sided structure, measuring $25 \times 20 \times 14$ cm, that provided a 25×20-cm roof supported on two 20×14-cm legs. The food bowls rested on the floor under the roof.

For observers assigned to the 'near condition', we placed food bowls and cover (when appropriate) abutting the entrance to the nestbox, so that observers could eat without crossing open ground. For observers assigned to the far condition, we placed both food bowls and cover (when appropriate) 1.3 m from the nestbox entrance (Fig. 1).

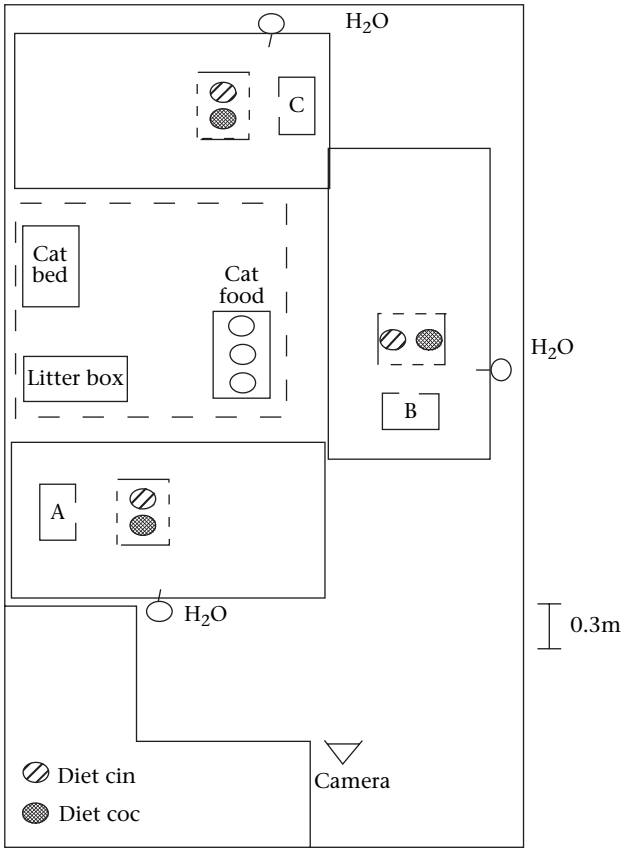

Figure 1. Overhead view of the room where we conducted experiments 1 and 2. Enclosure A is configured for the near-covered condition in experiment 1, enclosure C for the far-covered condition in the same experiment and enclosure B for experiment 2.The dashed line indicates the area where we held cats in the 24-h and 4-h caged conditions of experiment 2.