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Effects of Food-handling Time on Scanning Rates among American Goldfinches

JAMES W. POPP
University of Wisconsin—Milwaukee Field Station, 3095 Blue Goose Road, Saukville, Wisconsin 53080 USA

Vigilance rates among foraging birds may be influenced by a number of factors, including flock size, predation risk, and energetic demands (Pulliam et al. 1982, Lendrem 1983, Metcalfe and Furness 1984, Popp 1986). One recent hypothesis predicts that scanning rates should also be constrained by the time required to handle food items (Lendrem 1983). The more time required to manipulate food items, the less time available for scanning. I investigated how food-handling times affected scanning rates among American Goldfinches (*Carduelis tristis*) foraging at a winter feeding station.

American Goldfinches were videotaped while on a feeder at Elkhart Lake, Sheboygan Co., Wisconsin, during February and March 1985. The feeder was stocked with small, black oil-type sunflower seeds (*Helianthus annuus*) or with niger (thistle) seeds (*Guizotia abyssinica*). Handling of niger seeds (typical size: 1 × 5 mm) involved simply pecking at the seeds and swallowing them. In contrast, the unhusked sunflower seeds (typical size: 6 × 12 mm) required considerable manipulation to find the crack in the husk and break it open. Handling times for the niger seed were difficult to measure but were typically around 0.1 s or faster. Handling times for the sunflower seeds generally exceeded 0.4 s (Table 1). The mean value given

TABLE 1. Mean handling times, scanning rates, and scan durations for American Goldfinches feeding on niger or sunflower seeds (*t*-test for unequal variances). Standard deviations are given in parentheses.

	Seed type				
	Niger	Sunflower	*t*	df	*P*
Handling time (s)	0.12 (0.04)	1.45 (0.34)	—[a]		
Scanning rate (scans/min)	37.92 (6.48)	6.45 (2.00)	32.93	58.3	<0.001
Scan duration (s)	0.14 (0.09)	0.37 (0.17)	6.16	37.3	<0.001

[a] *t*-test not performed (see text).

for handling niger seed is an overestimate because times faster than 0.1 s could not be measured accurately and were rounded to 0.1 s.

The scanning rates of the first 50 visits by goldfinches to the feeder stocked with niger seed were compared with the first 50 with sunflower seeds present. Scanning rates were measured only during active feeding bouts. Because of intense competition for access to the feeder, most time on the feeder was spent feeding. Because group size influences scanning rates among goldfinches (Popp 1986), visits were included only when 2 birds were at the feeder (modal group size). A scan was considered to have occurred when a goldfinch lifted its head to horizontal, sometimes turning it sideways, and then returned to feeding. Scans could be nearly instantaneous or last more than 0.5 s. By using slow-motion replays, scan durations were sampled by measuring the length of the fifth scan made by the first 25 birds visiting the feeder when niger seeds were present and those made when sunflower seeds were present.

Mean scanning rates were higher with the more easily handled niger seed (Table 1). A comparison of scan durations indicated that the goldfinches did not reduce the time spent scanning while feeding on sunflower seeds as much as indicated by their scanning rates. The mean scan duration was longer when feeding on sunflower seeds than on niger seeds (Table 1). The scan durations appeared to be longer because the birds used part of the time spent manipulating the seeds in their beaks to scan. Goldfinches often scanned while manipulating sunflower seeds in their beaks.

The time spent scanning per minute of visit on the feeder was estimated by multiplying scanning rates by the scan duration. These results indicate that goldfinches spent more time scanning when feeding on niger seed (niger: 5.61 s/min of visit, sunflower: 2.25 s/min of visit). The time spent scanning was influenced by food-handling time, but the difference was not as great as might be expected because food handling and vigilance were not completely incompatible. Goldfinches could handle sunflower seeds and scan at the same time. In fact, they adjusted their scan durations to fit their food-handling method.

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