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Burrowing Owl (*Athene cunicularia*) responses to alarm calls of black-tailed prairie dogs (*Cynomys ludovicianus*).

In species living in social groups, individuals rely on collective vigilance to increase their foraging time while decreasing their risk of predation. Vigilant individuals will use alarm calls to alert group members to danger, especially predators (Manser et al. 2001, Hollen and Radford 2009). A system like this minimizes the energy required by any single individual to avoid predation, while maximizing the amount of time they are able to forage (Beuchamp and Ruxton 2007). Animals sharing a common habitat will sometimes take advantage of each others' vigilance by eavesdropping on their neighbors' alarm calls. Heterospecific eavesdropping has been studied extensively in several bird, mammal, and reptile species (Randler 2005, Magrath et al. 2007, 2009, Vitousek et al. 2007, Lea et al. 2008). Eavesdropping individuals are able to enhance their own fitness by paying attention to other species' alarms.

In Colorado, burrowing owls are listed as a state threatened species (CDOW 2010). In Colorado and the Rocky Mountain Region, burrowing owls use unoccupied black-tailed prairie dog burrows on active towns. On active prairie dog colonies, nesting success rates are higher and predation rates are lower than on inactive black-tailed prairie dog colonies in Oklahoma (Butts and Lewis 1982) and in the Rocky Mountain Region (Desmond et al. 2000, Sidle et al. 2001, McDonald et al. 2004). In this study, I test the hypothesis that burrowing owls eavesdrop on prairie dog alarm calls. If prairie dog alarm calls help nesting owls detect threats, there is a distinct advantage to nesting on active prairie dog colonies. Earlier predator detection and avoidance behaviors resulting from prairie dog vigilance could enhance owl nest survival.

Data Collection

With permission of the Central Plains Experimental Range (CPER) and the National Forest Service, I conducted playback experiments on 14 different prairie dog colonies on the CPER and the Pawnee National Grasslands (PNG). During the months of June and July 2011, I played sounds to owls nesting at 20 different locations on these colonies. I played a series of sounds to each bird: a prairie dog alarm call (the experimental treatment), a low-flying airplane engine (a non-biological control), and cattle mooing (a biological control). Each sound lasted 30 seconds, and the sounds were separated from

each other by a full minute of ambient noise. I randomized the order in which I presented the sounds in each trial, and I video-recorded all trials.

For each trial, I placed a speaker within 5 to 10 meters of a nest burrow. Owls usually flushed or ducked into a burrow upon my arrival. Before beginning any playbacks, I waited in a blind (either the truck or a pop-up blind) for the bird to return to the vicinity of the speaker. In some trials the owl was as close as 5 meters from the speaker, while in others the speaker was up to 30 meters away. The blind was 25 to 50 meters from the nest burrow and/or focal owl for all trials. I used a pop-up hunting blind when it was not possible to use the truck as a blind. I began each playback series with two full minutes of ambient noise, and ended with 30 seconds of ambient noise. Because the birds were unmarked, it was not possible to determine which experiments were repeated on the same bird on different days, and I will need to account for this fact in my statistical analyses.

Preliminary Data Analysis

I organized and scored video files using JWatcher®1.0 software (Blumstein and Daniel 2007) using the following ethogram: vigilance (looking in any direction with an alert posture), locomotion, flight, foraging, preening, vocalizing, bobbing, or out of sight. I also included modified vigilance scoring for times I knew the bird was looking directly at the speaker or directly at me/the video camera. If the owl moved/flew farther than 30 meters from the speaker during the playback, or ducked underground and did not re-emerge, I did not include the scored trial for use in my final analyses. With that constraint, at this time I have 64 useable scored videos of adult owls. I also have 24 useable scored videos of juvenile owls, which I may use in future analyses. Of the 64 adult owl records, results are distributed as follows across three different orders of sound cues: Order 1 – prairie dog alarm (A), cattle mooing (M), airplane (P): ***N = 24***; Order 2 – M, P, A: ***N = 20***; and Order 3 – P, A, M: ***N = 20*** (table 1).Trials are distributed across the nesting stage of the owls as follows: young unseen/failed nest: ***N = 11***, underground (un-hatched, hatchling); ***N = 18***, and above ground (nestling, mobile); ***N = 35*** (table 2).

I will use the JWatcher® files I have created to determine the proportion of time owls devote to vigilance before, during, and after each of the presented sound cues. I will focus on parameters including latency to response to sound cues, duration of each vigilance bout, the intervals between vigilance bouts, and the time allocated to other “non-vigilant” behaviors during trials. Using these data, I hope to show that the burrowing owls increase their vigilance when they hear a prairie dog alarm call.

	Colony/ Location	Total Number of trials	Sound order		
			AMP	PAM	MPA
1	Carroll	1	1	0	0
2	CPER A	6	2	1	3
3	CPER B2	5	2	1	2
4	CPER D	2	1	1	0
5	CPER E	6	1	2	3
6	E. Stoneham	4	1	1	2
7	E. Stoneham B	5	3	1	1
8	Halter	2	0	1	1
9	Halter 1	1	1	0	0
10	Halter 2	5	1	2	2
11	Keota	3	1	1	1
12	Reno 1	6	2	3	1
13	Reno 2	2	1	1	0
14	Tappy	4	2	2	0
15	Tappy B	8	2	3	3
16	W. Stoneham	4	3	0	1
	Total	**64**	**24**	**20**	**20**

Table 1. Trials by type and colony. The sixteen owl nest locations are listed in the left column by prairie dog colony name, followed by the total number of trials run at each location. Trials are subdivided into trial types. Initials refer to the order of sound cues played in the trial. AMP = prairie dog alarm, cattle mooing, airplane engine; MPA = cattle mooing, airplane engine, prairie dog alarm; PAM = airplane engine, prairie dog alarm, cattle mooing. Each playback started with 2 minutes of ambient noise, and there was 1 minute of ambient noise between each sound stimulus.

	Colony/ Location	Total Number of trials	Number of trials and trial type per nest stage			
			Underground		Above ground	
			Un-hatched	*Hatchling*	*Nestling*	*Mobile*
1	Carroll	1	1 (AMP)	0	0	0
2	CPER A	6	4 (all orders)	0	1 (AMP)	1 (PAM)
3	CPER B2	5	1 (PAM)	0	1 (AMP)	3 (all orders)
4	CPER D	2	0	0	1 (MPA)	1 (AMP)
5	CPER E	6	1 (AMP)	0	3 (PAM, MPA)	2 (PAM, MPA)
6	E. Stoneham	4	4 Unseen (all orders)		0	
7	E. Stoneham B	5	1 (AMP)	2 (AMP)	2 (PAM, MPA)	0
8	Halter	2	0	0	0	2 (PAM, MPA)
9	Halter 1	1	1 Unseen (AMP)		0	
10	Halter 2	5	0	0	5 (all orders)	0
11	Keota	3	3 (all orders)	0	0	0
12	Reno 1	6	0	0	5 (AMP, MPA)	1 (PAM)
13	Reno 2	2	2 Unseen (AMP, MPA)		0	
14	Tappy	4	4 Unseen (AMP, MPA)		0	
15	Tappy B	8	1 (MPA)	4 (all orders)	3 (all orders)	0
16	W. Stoneham	4	0	0	4 (AMP, PAM)	0
	Total	**64**	**29**		**35**	

Table 2. Trials by colony and nest stage. The sixteen owl nest locations are listed in the left column by prairie dog colony name, followed by the total number of trials run at each location. Trials are subdivided into the total number of trials while young are underground (eggs or newly hatched) and total number of trials while chicks are above ground. Initials next to numbers refer to the order of sound cues played in the trial.