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Sandhill Crane Dancing During The Spring Migration

James R. Gray
Kearney State College

Thomas F. Sweeney
Saint Louis University

SANDHILL CRANE DANCING DURING THE SPRING MIGRATION

JAMES R. GRAY

Kearney State College, Kearney, Nebraska 68847
Present address: Columbus Middle School
Pittsburgh, Pennsylvania 15213

and

THOMAS F. SWEENEY

Saint Louis University, St. Louis, Missouri 63108

The role, intensity, and frequency of Lesser Sandhill Crane *(Grus canadensis)* dances were interpreted from observations of 1,167 dance sequences from March 6, 1975, to April 15, 1975. The observations were from 27 sites in Kearney and Hall Counties, Nebraska.

Nineteen variables, selected as possible determinants of dance frequency (dances/minute), were recorded on field observation forms along with a description of each dance and the approximate duration.

The 19 variables were regressed against the dance frequency of the total dances as well as 6 subgroups–courtship display, emotion or tension-release, aggression-related activity, pre-flight and pre-walk communication, and response to possible danger. Primary factors selected as influencing the dance frequencies of all the dances collectively included: relative density, distance to the nearest road, date, time, flock size, circular flock shape, and grazing in corn stubble. Primary predictors were also selected for each of the 6 dance types.

The intensity (duration) of each dance was recorded. As the migratory season progressed, the dance frequency increased, whereas, the intensity decreased. This was primarily due to an increase in tension-release and aggression-related dances of which nearly 97% lasted less than 30 seconds.

† † †

INTRODUCTION

Heineman (1954) wrote that the dance display of the lesser Sandhill Crane was a "sight to behold" and a "joy for nature lovers." Several investigators felt that this avian phenomenon was more than a pleasure for bird watchers, so they devised studies to determine the value of the behavior to the cranes.

Fey (1965) and Schaffer (1968) referred to the dance as a curious courtship display; however, many investigators have reported this to be only part of the value. Functions also ascribed to the dances were: aggressive maintenance of an individual territory (Farrar, 1975; Keith, 1962; and Walkinshaw, 1949); pre-flight communication (Walkinshaw, 1949); response to a possible danger (Keith, 1962); an emotional outlet or tension-release activity (Farrar, 1975; Keith, 1962; McNulty, 1966; and Walkinshaw, 1949). Thus, 5 functions have been proposed as roles of crane dancing.

In this study, research was conducted to determine the frequency (dances/minute of observation), intensity (time duration of individual dance sequences), and the role of this behavior during the spring migration of Sandhill Cranes through central Nebraska.

MATERIALS AND METHOD

The dancing behavior of Sandhill Cranes was observed for two periods during the spring migration: March 6, 1975-March 18, 1975, and March 31, 1975-April 15, 1975. Listed in Table I are the dates of field observations, the length of time spent at each site, the total number of dances recorded per site, and the dance frequency for each of the 27 sites.

In Kearney County, Nebraska, the study was bordered on the west by Nebraska Highway 44; on the south by a county road 1 mile south and running parallel to Nebraska Link 50A connecting Nebraska Highways 10 and 44; on the east by a county road 2 miles east and running parallel to Nebraska Highway 10; and on the north by the Platte River. In Hall County, all observations were within a 1-mile radius of the intersection of Nebraska Highway Link 40C and Platte River Drive, with two exceptions–one observation on Shoemaker Island and another approximately 1 mile south of the south channel of the Platte River and .3 miles west of Nebraska Highway 281.

Approximately one hour was spent at each site ($\bar{X}$ = 58.15 minutes/site). Observations were recorded on tape and later transcribed onto a form devised for the study which provided space for recording individual bird behavior during and following a dance. Included in this section were the actions of the dancers and responses of surrounding birds, plus an approximate duration of each dance sequence, i.e., a = 1 to 30 seconds, b = 30 to 60 seconds and c = more than 60 seconds.

Table I:

Date, Duration, Number of Dances and Dance Frequency For the 27 Observation Sites

Date of Observation	Time at Site (minutes)	Total Number of Dances	Dance Frequency
March 6, 1975	20	1	.0500
March 6, 1975	80	11	.1375
March 8, 1975	56	28	.0500
March 8, 1975	30	2	.0667
March 8, 1975	29	5	.1724
March 11, 1975	81	73	.9012
March 11, 1975	45	26	.5778
March 13, 1975	40	25	.6250
March 13, 1975	49	35	.7143
March 15, 1975	32	1	.0312
March 15, 1975	25	7	.2800
March 18, 1975	30	7	.2333
March 18, 1975	60	36	.6000
March 31, 1975	51	45	.8824
March 31, 1975	40	9	.2250
March 31, 1975	61	42	.6885
March 31, 1975	138	289	2.0942
April 1, 1975	60	18	.3000
April 1, 1975	72	93	1.2917
April 1, 1975	40	4	.1000
April 3, 1975	120	62	.5166
April 5, 1975	86	158	1.8372
April 6, 1975	40	70	1.7500
April 8, 1975	42	30	.7142
April 8, 1975	60	11	.1833
April 12, 1975	123	75	.6098
April 15, 1975	60	4	.0667
	1570	1167	.7668

The following is a hypothetical Part II of the recording form indicating the 6 dance types that the author determined were roles of crane dancing: emotional outlet, aggression-related activity, courtship display, response to possible danger, pre-flight and pre-walk communication. The dances are recorded in a long form and on an abbreviated form adopted by the author as the study progressed.

DESCRIPTION OF DANCES

Bird A flapped and jumped twice and then ran around Bird B with small steps. Bird A then threw sticks into the air. Birds A and B then alternated jumps; A stopped jumping, but B jumped one more time. Both birds bobbed their heads, alternating the bobs with sigmoid neck postures. Bird A "craned" its neck and appeared to sing for about 10 seconds. Both birds returned to grazing. The dance sequence lasted longer than 30 seconds, but less than 60. [A f + j 2x, A small steps B, A sticks. AB alt. j, B j. AB alt. bob and sigmoid. A sing 10 secs. (b)].

Bird A flapped twice, then it flapped and jumped into the air. After a pause of 10 seconds, it flapped and jumped twice, running to a point about 15′ outside of the flock. It jumped one more time and then returned to grazing. The dance sequence lasted between 30 and 60 seconds. [A f 2x, A f + j, 10 secs., A f + j 2x, flock ↔ 10′. j. (b)].

Bird A pecked at Bird B; the latter flapped and jumped into the air and then ran about 10′ from Bird A. The sequence lasted less than 30 seconds. [A → B, B f + j, B → 10′. (a)].

Bird A flapped and jumped into the air three times. After a pause of 5 seconds, Bird A and 4 other birds flew from the flock and out of the sight of the observer. The dance sequence lasted less than 30 seconds. [A f + j 3x, 5 secs., A + 4 fly. (a)].

Bird A flapped and jumped. Immediately Bird A and 35 birds walked 35′ to the west of the flock and began grazing. The sequence lasted longer than 60 seconds. [A f + j, A + 35 walk → 35′ W. (c)].

As the observer's car approached, all birds within 100 yards of the road flew away; 15 birds remained flapping and jumping for more than 30 seconds. [Car, all ⟨ 100 yards fly, 15 f + j 30 secs. (b)].

Supplementary recording sheets were used to record only the individual dancing section. A change in the first section required using Parts I and II, e.g. abrupt wind changes, commencement of precipitation, or large additions to the flock.

RESULTS AND DISCUSSION

The dance frequency at each of the 27 sites was determined by dividing the total number of dances by the time spent at each site. The word "dance" was used to describe a particular action of the Sandhill Cranes, specifically the act of leaping into the air and flapping the wings. This definition was the same as that used by Keith (1962) when describing a similar activity of the Japanese Crane *(Grus japonensis)*. In the preceding section, the dances were referred to as "f + j" in the author's notation. By Keith's definition, each "f + j"

was actually a dance, such that if 6 cranes flapped and jumped, then 6 dances occurred. However, in this study, each individual bird was not counted, but rather the entire dance sequence was referred to as one dance with one-to-several participants. The number of dance sequences observed was 1,167, but the total number of participants was more than 5,000.

Each of the dance sequences was classified as one of 6 dance types: courtship (Type I), emotion or tension-release (Type II), aggression-related (Type III), pre-flight communication (Type IV), pre-walk communication (Type V), and a response to possible danger (Type VI). The dance types will be discussed separately following a review of the factors affecting all the dances collectively.

The frequencies of the 27 sites were correlated with 19 variables by a forward selection step-wise multiple regression analysis (IBM, 1975). The simple linear correlation of each variable to the dance frequency is shown in Table 2. It was considered unlikely that a single factor would be the sole primary predictor of dance frequency; therefore, in order to determine the importance and selection order of the independent variables, a forward selection step-wise regression was considered appropriate. The variables were adapted for computer programming as follows:

1. dependent variable: dance frequency (f = dances/minute of observation).
2. date: March 6, 1975 = 1 to April 15, 1975 = 40.
3. latitude: degrees, minutes, and seconds were converted to degrees.
4. longitude: same method as latitude.
5. distance from the nearest road: in yards. Observations were always from the nearest road to the flock, but not necessarily from the nearest point on that road.
6. time of day: 9:00 A.M. = 0 to 7:00 P.M. = 660.
7. alfalfa field: 1 = yes, 0 = no.
8. corn stubble field: 1 = yes, 0 = no.
9. pasture: 1 = yes, 0 = no.
10. temperature: 15^{o} = 0 to 52^{o} = 37.
11. precipitation: 1 = yes, 0 = no.
12. cloud cover: 0% to 100%.
13. wind direction: in degrees.
14. wind speed: 0 = 4 mi/hr to 11 = 15 mi/hr.
15. flock size: number of cranes.
16. relative density: 0 = well-spaced to 3 = dense.
17. middle of field: 1 = middle, 0 = nearer perimeter than middle.
18. rectangular flock shape: 1 = rectangular, values from 0 to 1.
19. barbell flock shape: 1 = barbell shape, values from 0 to 1.
20. circular flock shape: 1 = circular flock shape, values from 0 to 1. There were 18 different shapes for the 27 sites, but they were encompassed by these 3 forms.

The simple linear correlations indicated separately the relationships of the 19 variables to the dance frequency. For example, variable 16 had a relatively high correlation, .468; variable 4 had a low positive correlation, .025; and variable 11 had a negative correlation, -.145. One would deduce from these values that density and precipitation were relatively more important in explaining dancing than longitude; that is, as the relative density increased or as the precipitation decreased, the likelihood of dancing increased.

When the observed values for both the independent and dependent variables were entered into the regression, the resulting correlation coefficient was .772. The order of variable selection is included in Table II.

The multiple regression analysis provided two analyses of the effect of the variables upon dance frequency. Without mathematical transformations, it provided an index of the relationship of the interaction of the 19 variables to the dance frequency. The multiple correlation coefficient indicated the combination of variables that affected the observed activity, providing an initial assessment of the primary factors which accounted for the dancing. By transforming the variables mathematically, a more accurate predictor of dance frequency was developed. The better model was attained by deleting the least important predictors in the initial trial and entering higher order terms of the selected predictors, such as square roots, squares, and natural logarithms (Table III). Introduction of these terms permitted the development of an equation that better approximated the actual dance frequency. The partially transformed data yielded a multiple correlation coefficient of .972.

Fritts (1960), in discussing the validity of the step-wise multiple regression analysis for analyzing field observations, stated that beyond predicting the dance frequency, transformed variables afford some indication of those factors that

Table II:

Simple Linear Correlations of the 19 Untransformed Variables to the 6 Dance Types
And to all the Dances Collectively

Variable	Dance Types						
	I	II	III	IV	V	VI	All Dances
1*	Dependent Variable: Dance Frequency						
2	-.313(3)**	.453(2)	.326(2)	-.132(3)	-.036(15)	.108(10)	.333(2)
3	-.007(10)	.212(15)	.096(8)	.028(8)	.260(11)	-.490(1)	.124(6)
4	.276(14)	-.154(14)	.077(15)	.124(11)	-.254(10)	-.210(9)	.025(14)
5	.083(8)	.010(13)	.244(3)	.147(7)	-.291(3)	-.341(4)	.189(7)
6	.331(17)	.526(1)	.235(4)	.140(13)	-.152(16)	-.110(17)	.360(11)
7	-.202(19)	-.252(18)	-.232(9)	-.188(2)	.114(8)	-.206(7)	-.276(13)
8	.207(5)	.114(19)	.003(17)	-.025(12)	-.342(19)	-.076(18)	.042(17)
9	-.104(18)	-.024(12)	.130(16)	.134(14)	.296(12)	.199(5)	.114(18)
10	.010(4)	.331(7)	.218(7)	.063(10)	.071(18)	.052(13)	.255(15)
11	-.145(6)	-.113(4)	-.159(18)	-.096(5)	.135(5)	-.075(6)	-.165(19)
12	-.201(13)	-.191(3)	-.283(10)	-.010(9)	-.246(9)	.230(12)	-.296(4)
13	.110(11)	-.144(5)	.006(19)	.081(15)	-.394(1)	-.096(19)	-.072(9)
14	-.049(8)	.315(9)	.148(14)	.202(4)	.136(2)	-.158(15)	.154(8)
15	.303(7)	.073(8)	.150(12)	.259(1)	-.051(6)	-.374(3)	.158(10)
16	.573(1)	.334(6)	.434(1)	.233(17)	-.141(4)	-.341(11)	.468(1)
17	.238(12)	.189(10)	.093(13)	-.016(16)	.090(13)	.467(2)	.124(12)
18	-.300(14)	-.160(17)	-.194(11)	.139(19)	.136(17)	-.047(16)	-.237(16)
19	.371(2)	-.101(11)	.163(5)	.049(18)	-.047(7)	-.190(14)	.159(5)
20	.020(16)	.298(16)	.164(6)	-.198(6)	-.137(14)	.150(8)	.414(3)

* The variables are listed according to explanation in the Results and Discussion section.

** In parenthesis is the selection order of the variables by the regression analysis.

were the most influential in controlling the activity. Only 5 variables and their transformations and 4 untransformed variables were selected to provide the .972 correlation coefficient. Thus, factors indicated as being primary predictors of dancing were relative density, distance to the nearest road, date, time of day, temperature, flock size, barbell flock shape, and a central position in a corn stubble field.

The selection of 8 of these 9 variables was not unexpected since the simple linear correlation coefficients of all except corn stubble was greater than .158. Corn stubble was highly correlated with density and the distance to the nearest road which could account for its selection.

The same variables used in the first analysis were used in a step-wise multiple regression analysis for each of the 6 dance types. Table 4 lists the dance frequency for the 6 dance types for each site.

Table III:

Simple Linear Correlations of the Transformed and Untransformed Variables for the 6 Dance Types And all the Dances Collectively

Variable	Dance Types						
	I	II	III	IV	V	VI	All Dances
(2)*	-.181(3)**	.247(6)	.232(20)	-.134(9)	-.131(3)		
$(2)^{\frac{1}{2}}$	-.299(9)	.451(2)	.363(2)				.373(2)
$(2)^2$	-.321(6)	.410(10)	.244(21)				.252(14)
$(2)^3$		.342(9)					.170(12)
(3)						-.490(4)	
(5)	.083(*)		.329(5)		.341(5)	-.341(12)	.189(17)
$(5)^{\frac{1}{2}}$	.079(10)		.199(11)	.176(8)			.150(18)
ln(5)			.155(12)	.200(14)			.112(*)
1/(5)			-.076(*)	-.225(15)			-.045(*)
$(5)^2$	.093(11)		.244(6)	.043(7)			.264(5)
$(5)^3$						-.270(5)	.330(4)
(6)		.526(19)	.235(15)				.360(3)
ln(6)		.281(5)	.184(16)				
$(6)^{\frac{1}{2}}$		.412(13)	.217(7)				
$(6)^2$		.656(1)					
1/(6)		.089(18)	.100(10)				
(7)					.114(10)	-.206(15)	
(8)	.207(5)		.003(13)				.042(9)
(9)					.296(8)		
(10)	.010(12)	.331(7)	.218(17)	.063(*)			.255(16)
$(10)^{\frac{1}{2}}$	.082(4)						.186(15)
$(10)^2$				.042(11)			.313(13)
$(10)^3$				.101(10)			.338(11)
(11)	-.145(7)	-.113(8)		-.096(*)	.135(12)	-.075(9)	
(12)		-.191(*)		-.010(16)			-.296(*)
(13)		-.140(11)	.006(18)		-.394(1)		
$(13)^{\frac{1}{2}}$					-.386(*)	-.063(8)	
ln(13)					-.368(*)		
$(13)^2$				.152(*)	-.376(*)		
$(13)^3$				.203(12)	-.334(*)		
1/(13)					.324(4)		
(14)	-.049(*)	.315(*)	.148(19)	.202(*)	.136(2)		

Table III (Continued)

Variable	Dance Types						
	I	II	III	IV	V	VI	All Dances
$(14)^{1/2}$				.126(6)			
$(14)^2$				.164(18)			
$(14)^3$				.286(3)			
(15)	.307(*)	.073(12)		.259(13)	-.051(16)	-.374(14)	.158(10)
$(15)^{1/2}$		.141(16)		.314(*)	-.021(11)	-.363(6)	
ln(15)	.383(8)	.216(17)		.345(1)	.018(9)	-.302(1)	
1/15		-.304(14)		-.311(17)	-.083(7)	.076(3)	
$(15)^2$	.164(14)			.140(4)	-.084(15)	-.333(13)	
$(15)^3$				.048(2)	-.098(14)		
(16)		.334(4)	.434(14)		-.140(6)		
$(16)^{1/2}$	.573(1)	.364(3)	.421(3)			-.346(11)	.469(2)
$(16)^2$	.482(18)	.267(*)	.452(4)			-.322(10)	
$(16)^3$		.207(15)	.460(1)				.423(6)
(17)					.096(17)	-.467(2)	.124(8)
(19)			.164(8)		-.047(13)		.159(7)
(20)			.163(9)	-.198(5)		.150(7)	
a	.860	.907	.745	.831	.731	.873	.963
b	.048	.075	.284	.016	.012	.010	.161

* The numerals upon which the transformations are being performed refer to the explanation in the Results and Discussion Section.

** In parentheses, following the correlation coefficients, is the selection order of the variable by the step-wise multiple regression analysis. Variables rejected at a constant to limit variables = .001 are denoted by an asterisk (*).

a Final multiple correlation coefficient adjusted for degrees of freedom.

b Standard error of estimate.

Table IV:

Frequencies and Percentage of Total Dances of the 6 Dance Types

Site	Dance Types					
	I	II	III	IV	V	VI
1	.0500	.0000	.0000	.0000	.0000	.0000
2	.2727	.0750	.0008	.0909	.0000	.0000
3	.0357	.1964	.1964	.0178	.0357	.0178
4	.0000	.0333	.0000	.0000	.0333	.0000
5	.0345	.0345	.0345	.0000	.0000	.0690
6	.3210	.0864	.4815	.0123	.0000	.0000
7	.1111	.0889	.3111	.0667	.0000	.0000
8	.2000	.1500	.2250	.0500	.0000	.0000
9	.2449	.1428	.3265	.0000	.0000	.0000
10	.0000	.0000	.0312	.0000	.0000	.0000
11	.0400	.0800	.1200	.0000	.0000	.0400
12	.0000	.0667	.0333	.0667	.0333	.0333
13	.2000	.1167	.2500	.0000	.0333	.0000
14	.0588	.1765	.5686	.0196	.0588	.0000
15	.0500	.0750	.0750	.0000	.0000	.0250
16	.0820	.2131	.2951	.0820	.0000	.0164
17	.1304	.3913	1.5362	.0217	.0145	.0000
18	.1000	.0000	.2000	.0000	.0000	.0000
19	.0278	.3472	.8889	.0000	.0000	.0278
20	.0000	.1000	.0000	.0000	.0000	.0000
21	.0250	.2500	.2083	.0083	.0278	.0139
22	.1628	.4186	1.2210	.0116	.0116	.0116
23	.1250	.7750	.7750	.0250	.0250	.0250
24	.0714	.2143	.3810	.0000	.0000	.0476
25	.0000	.0667	.0000	.0167	.0000	.0500
26	.0488	.2846	.2764	.0000	.0000	.0000
27	.0000	.0500	.0167	.0000	.0000	.0000
Total	.0928	.2039	.4389	.0151	.0099	.0112

Percentage of total number of dances:

I	12.08
II	26.56
III	56.64
IV	1.97
V	1.28
VI	1.46

Type I. Courtship Dances

Allen (1932), speaking for Sandhill Cranes, said "We feel some strange desire to dance as the nesting season approaches" and "in these dances there is no prize and no winner, and they are in no sense a marathon, but we dance merely for the pleasure it gives us to demonstrate to others of our kind our superior abilities." This bit of teleology captures the predominant interpretation of crane dancing through the years, a courtship display for pair-formation and bond-cementing.

Keith (1962) described a generalized courtship dance as including head-bobbing, sigmoid neck postures, flapping and jumping, and perhaps a dance flight. Keith was discussing the Japanese Crane, but the display is not unlike that of the Sandhill Crane. Two other components of the courtship dance were stick-throwing and duet calling. Often in courtship displays, one of the two cranes would pick up a stick, corn cob, or other available material and throw it into the air. Keith explained this behavior as a possible conflict between two drives or as an action related to nest building due to the bird's heightened emotional state and the presence of suitable nesting materials. The duet was often seen after a particularly intense dance by the two birds. Often, it involved both birds calling simultaneously; sometimes just the bird that initiated the dance sequence called. The duet calling was commonly followed by a return to grazing. The first dance included in the dance description section was an actual sequence that contained several of the gestures described by Keith.

Of the 6 types of dances, courtship was the third most common in number and frequency—141 dances and a frequency of .0928.

Interpretations of the simple linear correlations indicated that courtship dances were more likely to occur in dense, irregular-shaped flocks as the day progressed. The flock size was relatively important, perhaps providing, in larger flocks, an increased opportunity for bond-attempting interactions. The dance frequency was negatively correlated with the date, indicating that the amount of this type of dancing decreased as the migratory season progressed.

The circular and barbell flock shapes were generally mid-field shapes appearing not to have been influenced by surrounding physical features, such as fencerows and creeks. Rectangular flocks were more often formed by the boundaries of the field or were linearly arranged near the side of a field along a hedgerow or shelterbelt. The Type I dance frequency was positively correlated with the first two shapes and negatively with the latter, indicating that the cranes tended to court near the center of the field. A more direct interpretation leading to the same conclusion is that courtship dances were correlated positively with flock positioning in the middle of the field.

The variables temperature, density, date, flock size, and distance to the nearest road were transformed and selected by the program in the second regression analysis as primary predictors of courtship dance frequency, along with barbell flock shape, corn stubble, and precipitation.

Type II. Emotion or Tension-release Dances

There were several dances in which the cranes appeared to be dancing without a stimulus. The author felt justified in classifying these dances as tension-release dances because of the lack of observable stimuli and because of documentation by other observers. Keith (1962) quoted R. Allen as stating that mating-season increases in dance behavior might have been due to a nervous and emotional condition brought about by a seasonal development of the gonads. This hormonal condition resulted in a lowered threshold in spring that might have been triggered without a stimulus. This type of *in vacuo* activity, according to Wallace (1973) occurred in cases where a pattern had become ritualized. It is quite likely, therefore, that the ritual courtship display of the Sandhill Crane often manifested itself as an emotional outlet at apparently inappropriate times without a stimulus.

Type II dances often involved large sections of a flock. Brooks and Allen (1937) wrote that many times 6 to 8 cranes would climb to the top of a hill and have an "old-fashioned barn dance." The largest number of cranes observed by the author in an infectious communal dance was 15. There were several cases in which a car would come near the flock and 2 or 3 birds would begin dancing followed within seconds by several hundred other cranes dancing. In this study, these dances were considered as Type VI and not Type II dances. The correlation of Type II dance frequency to the distance to the nearest road supported this contention since this dance type had a very small positive correlation. This indicated that the distance to the nearest road and vehicle interference were not stimulatory. In Table II, high positive correlations to date and time are shown, indicating that this kind of dance increased both during the day and during the migration period.

Since there was a rather high positive correlation to circular flock shape and a large negative correlation to rectangular flock shapes, one would have expected a relatively high positive correlation to positioning in the middle of the field, which was the case. The field type did not seem to have a stimulating effect, but in the case of alfalfa, not a common feeding area, it was possibly limiting.

Time, date, cloud cover, precipitation, wind direction, wind speed, relative density, temperature, and flock size were selected as variables to be entered into a series of regressions. Cloud cover and wind speed were rejected at the limit imposed; therefore, the 7 remaining variables and their transformations were selected as primary predictors with a standard error of estimate of .075. The importance of relative density and flock size as primary predictors might indicate that the author was unable to recognize stimuli detected by the cranes.

Type III. Aggression-related Dances

Keith (1962) stated that when Japanese Cranes came together in a flock, a good deal of aggressive behavior took place and there was obviously some established hierarchy among them. These cranes displayed, in a manner similar to that of the Sandhill Cranes, either an "arched-over" or an "arched-under" posture, both of which showed the red crown patch of the aggressor to the aggressed. This posture was often observed in the aggressive encounters of the Sandhill Cranes. Both Keith (1962) and Walkinshaw (1949) stated that they never saw the aggressor unsuccessful, i.e., the aggressed crane failed to run away or it turned on the aggressor. This author found the aggressor to be successful in many cases but, by no means, all cases. In some cases, Bird A would chase Bird B in an arched-under posture; Bird B would run about 10′, turn, and return at Bird A with the same posture, chasing it away.

Farrar (1975) wrote that the cranes generally kept just beyond the striking range of their neighbors. This seemed to be the case with the observed birds since there was a high correlation between relative density and the aggressive dance frequency (.434). Nearly 57% of all the dances were aggression-related. Type III dances increased as the day and migration period progressed, as the flock became more crowded, and as the temperature increased. Density was clearly a contributing factor since, in many instances, a crane would dance or lunge at another crane which would jump from the first crane's striking range. This would begin a series of lunges at the original aggressed bird by several other birds when it apparently entered each of their individual territories.

In the final regression, the highest adjusted value for the number of degrees of freedom was after the twelfth step. Therefore, the 6 variables providing the most accurate estimate of Type III dance frequency were relative density, date, time, distance to the nearest road, circular and barbell flock shapes.

Type IV. Pre-flight Communicatory Dances

There is little information concerning the communication activity of Sandhill Cranes. Walkinshaw (1949) wrote that the birds would begin dancing at dawn, and the frequency would increase until about 7:30 A.M. when the birds would leave the roosting area for the feeding areas. Twenty-three of the dances observed involved the dancing of 1 or 2 birds which were joined by as many as 15 birds. In no case did more than the original bird(s) dance, but the action was continuous. The birds, upon stopping their dancing, would take 2 or 3 steps and fly away with the remainder of the non-dancers. Each time, the birds flew from the flock and out of the view of the observer.

In the 23 Type IV dances, most took place on pasture areas that were not primary feeding areas. In observation number 23—the only evening observation—5 of the 70 dances

were Type IV. It appeared that these dances–more than 20% of all Type IV dances–were for birds going to the roosting areas.

All simple linear correlations were less than .300. It should be noted that other than the birds dancing in response to the author's car, no dances were recorded for the first 10 minutes at each site. Thus, one would not expect the distance to the nearest road to be a limiting factor, such that all dances could be explained as responses to the observer's recent approach.

In the final regression, 8 variables and 14 transformations provided an equation with a standard error of estimate of .024. The factors selected were flock size, wind speed, circular flock shape, distance to the nearest road, date, temperature, wind direction, and cloud cover.

Type V. Pre-walk Communicatory Dances

The action of this dance type was similar to that of the Type IV dances, i.e., usually only 1 or 2 birds danced, but these birds were joined by a larger group of between 5 and 50 birds. Generally, the birds walked to the periphery of the flock and remained there or walked beyond it up to 50′.

In both pasture and alfalfa fields, which were not primary grazing areas, the cranes most commonly exhibited Type V dance behavior; whereas, this behavior was rarely observed in disced corn fields. This dance type occurred only 15 times, but it was quite unmistakeable. In one example, a single bird jumped several times, nearly circling its small flock of 26 other birds. As soon as it stopped dancing, the 27 birds walked approximately 50 yards to the other side of the field. The flock continued grazing for 40 minutes before 15 cranes landed near them and the original 27 flew away.

This was the only dance type positively correlated with precipitation. There was a relatively high negative correlation to the distance to the nearest road, indicating the dances occurred more commonly near the road than the center of the field. It is possible that despite the 10 minute adjustment period the birds, after a time, walked away from the observer's position. In only 2 cases, the cranes walked from the flock to a point nearer the observer, and both times the original distance to the observer was greater than 250 yards.

Eleven variables and transformations provided a multiple correlation coefficient of .906 with a standard error of estimate of .012. Wind direction, flock size, and their transformations contributed 8 of the 17 predictors; the other 9 predictors (wind speed, distance to the nearest road, relative density, alfalfa, pasture, precipitation, barbell flock shape, date, and position in the field) were not transformed.

It is interesting to note that flock size had a simple linear correlation of only .051, yet it was selected as a primary predictor for this dance type. This variable correlated highly with density (.410) and precipitation (.513), and as Fritts (1960) stated, it is often the interrelation of variables that accounts for the most accurate multiple regression correlation coefficient.

Type VI. Response to Possible Danger Dances

Farrar (1975) quoted P. Johnsgaard as saying that Sandhill Crane dances might be a response to agitation by man. In this study, however, cranes only responded to the approach of the observer's car by dancing in 12 of 27 cases. This would appear to remove man as the sole factor.

Apparently cranes became habituated to vehicles rather rapidly. The simple linear correlations indicated that one would expect birds in the southeast portion of the study range to dance less frequently in response to vehicles as possible danger. The sites in the southeast quandrant were most often along Nebraska Highway Link 40C in Hall County, a more travelled road than the county roads running north from Nebraska Highway Link 50A in Kearney County. The birds danced more commonly in response to cars in Kearney County; this was the case in 11 of the 17 dance sequences.

When the cranes were within approximately 150 yards of the road, they would dance and then fly–or fly immediately; whereas, those cranes beyond this distance did not appear to react to the car's approach. If birds were nearer the perimeter of the field, they were more responsive to possible danger stimuli, dancing in different cases when approached by cars, tractors, dogs, and even a flock of Canada Geese. There was one observation on the last day of the study period where the author was able to park no more than 75 yards from a flock of cranes in corn stubble.

Following a series of transformations, 9 variables plus transformations were selected as primary predictors: flock size, field position, latitude, distance to the nearest road, circular flock shape, wind direction, relative density, precipitation, and alfalfa.

DANCE INTENSITY AND FREQUENCY

Intensity is defined as the time, in seconds, per dance sequence. The intensity classifications were a = less than 30 seconds, b = between 30 and 60 seconds, and c = more than 60 seconds. In Table V the dance classes are listed for each of the dance types as well as all of the dances collectively; whereas, in Table VI, the dances are grouped according to the dates of observation. Of the total dances, 92.37% lasted less than 30 seconds; and of these, 86.5% were Type II and Type II dances which generally involved only 1 or 2 birds.

It was quite uncommon for a dance to last longer than 60 seconds (19/1167, 1.63%). In both Type V and Type VI dances, the duration included the time spent walking away

Table V:

Dance Intensity (Duration) for the 6 Dance Types

Dance Type	Intensity Classes						
	a*	% of "a" Dances	b	% of "b" Dances	c	% of "c" Dances	Total Number of Dances
I	118	10.95	18	25.71	5	26.32	141
II	290	26.90	15	21.43	5	26.32	310
III	643	59.65	15	21.43	3	15.29	661
IV	12	1.11	9	12.86	2	10.53	23
V	10	.93	3	4.28	2	10.53	15
VI	5	.46	10	14.28	2	10.53	17
Total	1078		70		19		1167
% all dances		92.37		6.00		1.63	

* a = less than 30 seconds.
b = between 30 and 60 seconds.
c = more than 60 seconds.

from the flock or potential danger. Thus, the time consumed was not always spent in actual dancing. In no case was Allen's (1932) "several hours continuous dancing" observed; although at observation site No. 17, the dance frequency (2.0942) indicated that the birds remained quite active for the 138 minutes of observation. However, the dances did not seem to be interrelated, nor did they appear to be of the infectious type exclusively.

Five courtship dances were observed that lasted more than a minute. These dances were quite involved, employing many of the gestures discussed previously. However, neither the number nor the intensity was that expected after reviewing the previously published literature.

According to Keith (1962), the Japanese Crane began dancing more frequently as migration approached and continued with increasing agitation until nesting time. Farrar (1975) stated that the Sandhill Cranes began elaborate displays during the migratory period nearly 2 months prior to the actual nesting period. Thus, one might expect an increase in the frequency and intensity of dances as the cranes became sexually aroused. The increase was quite substantial in the second period over the first, particularly for Type II and Type III dances. If proper stimuli were not present, an inappropriate display might have been manifested *in vacuo,* or if the proper stimuli were present, possibly the reaction was an increased number of protective dances of individual territory.

The frequency of Type I dancing decreased during the second period. Possibly because bonds were completed, emotional dances were performed for bond maintenance, i.e., Type III dances were actually protection for newly formed or revowed pairs.

The frequency for Types IV, V, and VI dances remained nearly the same for both periods. The dance frequency of the cranes increased as the breeding season neared, primarily due to the increased frequency of Type II and Type III dances. The intensity decreased during the same period for primarily the same reason, an increase in "a" class dances for Types II and III. However, in all dance types, except Type V, there was an increase in the shorter dance sequences and a decrease in the longer.

Table VI:

Intensity and Frequency for the Two Observation Periods

Dance Type		Intensity Classes and Frequency						
		a	f	b	f	c	f	Total Number of Dances
I	*	57	.099	11	.019	3	.005	71
	**	61	.061	7	.007	2	.002	70
II	*	47	.081	5	.009	2	.003	54
	**	243	.245	10	.010	3	.003	256
III	*	102	.177	4	.007	3	.005	109
	**	541	.545	11	.011	0	.000	552
IV	*	6	.010	4	.007	0	.000	10
	**	6	.006	5	.005	2	.002	13
V	*	3	.005	1	.002	2	.003	6
	**	7	.007	2	.002	0	.000	9
VI	*	0	.000	3	.005	2	.003	5
	**	5	.005	7	.007	0	.000	12
Total	*	217	.376	28	.048	12	.021	257
	**	861	.867	42	.042	7	.007	910

* March 6, 1975, to March 18, 1975. 577 minutes of observation, 13 sites.

** March 31, 1975, to April 15, 1975. 993 minutes of observation, 14 sites.

f = frequency

a = less than 30 seconds

b = between 30 and 60 seconds

c = more than 60 seconds

CONCLUSIONS

The dances of the Lesser Sandhill Cranes during their spring migration were divided into 6 types: courtship display (I), emotion or tension-release activity (II), agression-related dance (III), pre-flight (IV) and pre-walk (V) communication, and response to possible danger (VI).

Primary factors affecting dance frequency were determined by analysis of simple linear correlations and untransformed and transformed variables selected by a step-wise multiple regression analysis. Variables selected as primary predictors included:

Type I: temperature, relative density, date, flock size, distance to the nearest road, barbell flock shape, precipitation, and corn stubble.

Type II: time, date, relative density, distance to the nearest road, precipitation, wind direction, flock size, and temperature.

Type III: relative density, date, distance to the nearest road, time, circular and barbell flock shapes.

Type IV: flock size, wind speed, wind direction, distance to the nearest road, cloud cover, and circular flock shape.

Type V: flock size, wind speed, wind direction, distance to the nearest road, circular flock shape, relative density, pasture, alfalfa, precipitation, and middle of the field.

Type VI:	flock size, wind direction, middle of the field, latitude, distance to the nearest road, circular flock shape, relative density, precipitation, and alfalfa.
All Dances:	relative density, distance to the nearest road, circular flock shape, date, time, flock size, and corn stubble.

The intensity (duration) of each dance was recorded. As the migratory season progressed, the dance frequency increased, whereas, the intensity decreased. This was primarily due to an increase in Type II and Type III dances of which nearly 97% lasted less than 30 seconds.

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