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Biology

Activity budgets and exhibit use of captive grey wolves related to exhibit familiarity

March 27, 2015

## **Abstract**

Wild and captive grey wolves (*Canis lupus*) not only live in different habitats, but they also have different necessary survival activities. These differences give rise to questions concerning exhibit familiarity and the correlation with activity levels. In the present study, activity budgets of male grey wolves from two different locations with differing levels of exhibit familiarity were observed. The results of this study show that there is a significant difference between the activity levels and exhibit use of habituated wolves at the Milwaukee County Zoo and the unhabituated wolves at the Menominee Park Zoo. It is also shown that there is no significant change in activity over time in either wolf pack.

## **Key Words**

*Canis lupus*, habituation, Menominee Park Zoo, Milwaukee County Zoo, Wisconsin

## **Introduction**

Grey wolves (*Canis lupus*) are carnivorous, territorial, and cooperative mammals that live in hierarchical packs (Caniglia et al. 2014). These hierarchical packs are familial (Mech 1999) and usually are made up of a breeding pair, their pups, and occasionally other nonbreeding males and females (Cipponeri and Verrell 2003). This hierarchical pack dynamic results in differentiation of social roles between dominant, or alpha males and females, and the other pack members in the wild (Ruprecht et al. 2012). Most often the dominant or alpha male and female are the active breeders (Merrill and Mech 2003). The other pack members are often temporary because they are the offspring of the breeding pair and will leave the pack after one to two years (Mech 1999). In the wild, wolf packs inhabit very large home ranges, often of several hundred square miles (Kreeger et al. 1996). A large home range is expected for a carnivore like the wolf considering activities such as hunting practices; in terms of prey selection, search distance, and spatial use (Kunkel et al. 2004) and pup rearing.

In captivity the home range, pack structure, and daily activities of grey wolves differ than those of wild wolves. The home range of captive wolves is predetermined and restricted (Kreeger et al. 1996), these wolves do not hunt for their food, and the packs are often composed of unrelated wolves (Mech 1999). Therefore captivity may alter wolf behavior (Kreeger et al. 1996) and the enclosure structure and pack familiarity with the exhibit may affect expression of wolf behavior and activity levels.

Studying activity levels of captive animals can give important insight to the wellness of the animal (Clubb and Mason 2007), along with awareness of exhibit adequateness (Kreeger et

al. 1996). This study on activity levels and patterns of exhibit use will assess the wellness of two packs and may aid caretakers in exhibit maintenance decisions and future exhibit design.

The present study is a natural experiment in which I observed a familiar wolf pack at the Milwaukee County Zoo and an unfamiliar wolf pack at the Menominee Park Zoo. Both of these wolf packs are housed in exhibits that differ slightly in size but are made up of similar components. The pack at the Menominee Park Zoo was newly introduced to an empty exhibit in October of 2014 while the Milwaukee County Zoo pack was not new to the exhibit. This allowed me to assess the role of exhibit familiarity on wolf activity budgets.

The packs of interest in this study are composed of sibling wolves, this is an important point because captive wolf packs are often unrelated members forced to stay together (Mech 1999). Captive wolf packs of unrelated individuals may not behave the same as wild wolves who live in familial packs making it difficult to apply known information about wild wolves to captive packs (Mech 1999). In this comparative study of activity level, familiarity and exhibit use, both packs were composed of related individuals. Therefore observed differences are most likely caused by these variables and not because of artificial pack structure.

The aim of this study is to determine if there are differences in the activity budgets and exhibit use patterns of male grey wolves at the Milwaukee County Zoo who were intimately familiar with their exhibit in Milwaukee Wisconsin to that of male grey wolves at the Menominee Park Zoo who were unfamiliar with their exhibit in Oshkosh Wisconsin. I predict that activity levels of unfamiliar wolves will decrease over time as they habituate, activity levels will differ between the Milwaukee and Menominee Park wolf packs, and exhibit use will vary. It

is suspected that greater familiarity will result in lower activity and restricted exhibit use patterns.

## **Methods**

### **SUBJECTS**

Two packs of grey wolves were observed at two different zoos. One pack at Milwaukee County Zoo in Milwaukee, Wisconsin is composed of two 15 year old male wolves of the same litter from the International Wolf Center in Ely, Minnesota. They have been inhabitants of the Milwaukee County Zoo since they were 12 weeks old. The second pack is from the Menominee Park Zoo in Oshkosh, Wisconsin and is composed of two 11 year old males and two 11 year old females of the same litter. This pack arrived at the Menominee Park Zoo in October of 2014 from the Wildlife Science Center in Columbus, Minnesota. For this research the female wolves in the Menominee Park Zoo were omitted because they were a part of a different study.

### **BEHAVIORAL OBSERVATIONS**

This observational study took place from September 2014 to January 2015 at the Milwaukee County Zoo in Milwaukee Wisconsin and October 2014 to January 2015 at the Menominee Park Zoo in Oshkosh Wisconsin. Through the duration of this study both wolf packs were observed fifteen times for 90 minutes each session.

The activity level of each wolf was determined by scan sampling every five minutes for each of the 90 minute sessions. Eleven behaviors were used to determine activity; eat (E), drink (D), groom (Gr), sit (S), urinate (U), out of view (OOV), rest (R), stand tall (St), scan (Sc), trot

(T), and walk (W). Each of these behaviors is defined and categorized in terms of active and non-active and are summarized in the ethogram by Goodmann et al. 2002 (Table 1).

I examined exhibit use by recording each wolf's location within the exhibit during each scan sample. Four locations, consistent within each exhibit, were used to determine exhibit use; open(O), den (D), tree cover (Tr), and water (Wa). Table 2 can be referred to in defining these locations. I used Google Earth Pro to determine the area, in square meters, for each location category (Figs. 1 and 2).

## STATISTICAL ANALYSIS

To assess habituation I used Pearson Correlation Coefficient to analyze change in activity level over the 15 observation periods. Chi-Square Test of independence was used to analyze the relationships between activity level and exhibit use for each wolf pack (statistical significance was set at  $\alpha=0.05$  for all tests). To determine the predicted values for exhibit use, calculated percentages for open, tree cover, and water source were used. Predicted den use values were based upon den availability, two in Milwaukee and four at Menominee Park.

## Results

There was no significant difference in activity level trends over time for the Menominee Park Zoo ( $R^2=0.0017$ ; p-value=0.883253; Fig. 3) or the Milwaukee County Zoo ( $R^2=0.0325$ ; p-value=0.520916; Fig. 4).

There is significant difference between the activity levels of the Menominee Park Zoo wolves and the Milwaukee County Zoo wolves ( $\chi^2=245.2$ ; df=1; critical  $\chi^2=3.841$ ;  $p<0.00001$ ;

Fig. 5). The wolves at Menominee Park Zoo were approximately 10 times more active than the wolves at the Milwaukee County Zoo (60.35% vs. 6.67%).

Examining the use of each exhibit feature showed significant difference in the use of open area, tree cover, and water source between Menominee Park Zoo and Milwaukee County Zoo ( $\chi^2 = 78,322.08$ ;  $df=2$ ; critical  $\chi^2 = 5.991$ ;  $p < 0.00001$ ; Fig. 6). There was significant difference in den use between Menominee Park Zoo and Milwaukee County Zoo ( $\chi^2 = 112.42$ ;  $df=1$ ; critical  $\chi^2 = 3.841$ ;  $p < 0.00001$ ). The Milwaukee County Zoo pack used their dens much more than the Menominee Park Zoo pack (46.32% vs. 4.91%).

## **Discussion**

The hypothesis that familiarity with an exhibit influence activity budgets and exhibit use patterns was supported in this study. Wolves at Menominee Park Zoo, less familiar with their exhibit showed higher activity levels than wolves at Milwaukee County Zoo, very familiar with their exhibit. Furthermore, the wolves at the Menominee Park Zoo did not show evidence of habituating to their exhibit over the four months of the study. Unsurprisingly, the wolves at the Milwaukee County Zoo showed no signs of habituation.

For this study it was determined that the Milwaukee County Zoo wolf pack was habituated to their exhibit based on time spent there, 15 years, and preliminary observation. Since the Menominee Park Zoo wolf pack is new to the exhibit it was expected that the preliminary observations would show signs of being unhabituated (such as increased pacing). Although this study was done over the course of four months, I expected these behaviors would decrease. This idea is supported by a study done on Gorillas (*Gorilla gorilla gorilla*) where it was observed that through the habituation process some activity frequencies such as daily path

length were increased (Blom et al. 2004). These researchers also found that after the gorillas became habituated, or familiar with their surroundings they became much more relaxed and did not respond to humans in a fearful way. The data collected in this study showed that the activity level did not change, the Menominee Park Zoo wolves stayed consistently active throughout the course of observation. Unlike the Milwaukee County Zoo wolves, who also showed no change in activity over time, but are consistently much less active. This may indicate that the wolves at Menominee Park Zoo did not complete the habituation process during this study and needed more time to become familiar with their exhibit, or for a change in activity to be seen.

Although both of the wolf exhibits were composed of the same features, open area, tree cover, water source, and dens, the size of the exhibits did differ slightly. Referring to Figures 1 and 2 it is to be noted that the Milwaukee County Zoo exhibit is smaller than the Menominee Park Zoo exhibit. Seeing as the components of each exhibit were the same and that captive wolves do not alter their overall activity level in relation to the size of their enclosure (White 2001) this was not considered a significant factor.

Because of the results of this study I am able to suggest that captive wolf exhibits be composed of open area, tree cover, an open water source and dens. Based on the exhibit use statistics shown here I suggest that open area is very important for new wolf packs as this was used most by the Menominee Park Zoo wolves (Fig. 6). Looking at the exhibit use patterns of the Milwaukee County Zoo wolves I also suggest sufficient tree cover and dens be included in an ideal exhibit because as wolves become familiar these are the features used most (Fig. 6).

Gender and age are factors that were not included in this study. Although two female wolves were a part of the pack at the Menominee Park Zoo, I omitted them from the study



because there were no female wolves at the Milwaukee County Zoo. However my previous research indicated that male and female wolf activity at the Menominee Park Zoo did not significantly differ (Beisbier 2014). While Merrill and Mech 2003 report differences in male and female activity, their study was focused on breeding, pup rearing which was not a factor in the present study and further supports omitting gender as a factor in this experiment. In terms of age, all of the wolves were rather close in age, the Menominee Park wolves being 11 and the Milwaukee County wolves being 15. I did not consider age to be a relevant factor because in terms of the average wolf life-span they are both old packs. In the wild wolves may live to be 5 or 6 years old (Mech 1999) in captivity life expectancy is increased, but in this study the age of the wolves are quite comparable.

This study should be followed by a longer observation period to further validate the data presented here. It may also be beneficial to repeat this study on a young wolf pack or a wolf pack composed of non-related individuals.

## **Acknowledgements**

I would like to thank Dr. Memuna Khan for her guidance, advising, and constructive criticisms along with the Ripon College Biology Department. I would also like to thank Stacey Donnelly, Keelin Meese, and Tom Offer-Westort, of Menominee Park Zoo, and Tim Wilde along with Dawn Fleuchaus of Milwaukee County Zoo.

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Table 1. Ethogram of observed wolf behavior including category of each behavior observed.

<b>Behavior</b>	<b>Category</b>	<b>Definition</b>
Drink	Active	To ingest water
Eat	Active	To ingest food
Groom	Active	To care for coat by licking, nibbling, or scratching
Rest	Non-Active	Lying in a relaxed manner
Scan	Active	Wolf is drawn to full height, moving head and neck side to side
Sit	Non-Active	Rump, tail, and hind legs are on the ground, front legs straight, no locomotion
Stand Tall	Non-Active	Wolf is drawn to full height, no locomotion
Trot	Active	Diagonal two-beat gate, left rear and right front legs move together
Urinate	Active	To excrete urine in a raised leg, squat, or standing position
Walk	Active	Slow pace locomotion, lateral legs moving together
Out of View	Not Used	Wolf is not seen

Table 2. Exhibit feature categories and definitions.

<b>Category</b>	<b>Definition</b>
Open	No trees or water sources present
Tree Cover	Area of trees
Water	In ground water source. Excluding buckets for watering
Den	Housing area/ shelter



Figure 1. Menominee Park Zoo Oshkosh Wisconsin; grey wolf exhibit. Key: Black-exhibit border (Total area= $2,196.93 \text{ m}^2$ ), White-tree cover ( $432.90 \text{ m}^2$ ), Grey-water source ( $70.03 \text{ m}^2$ ). Open area ( $1,694.00 \text{ m}^2$ )

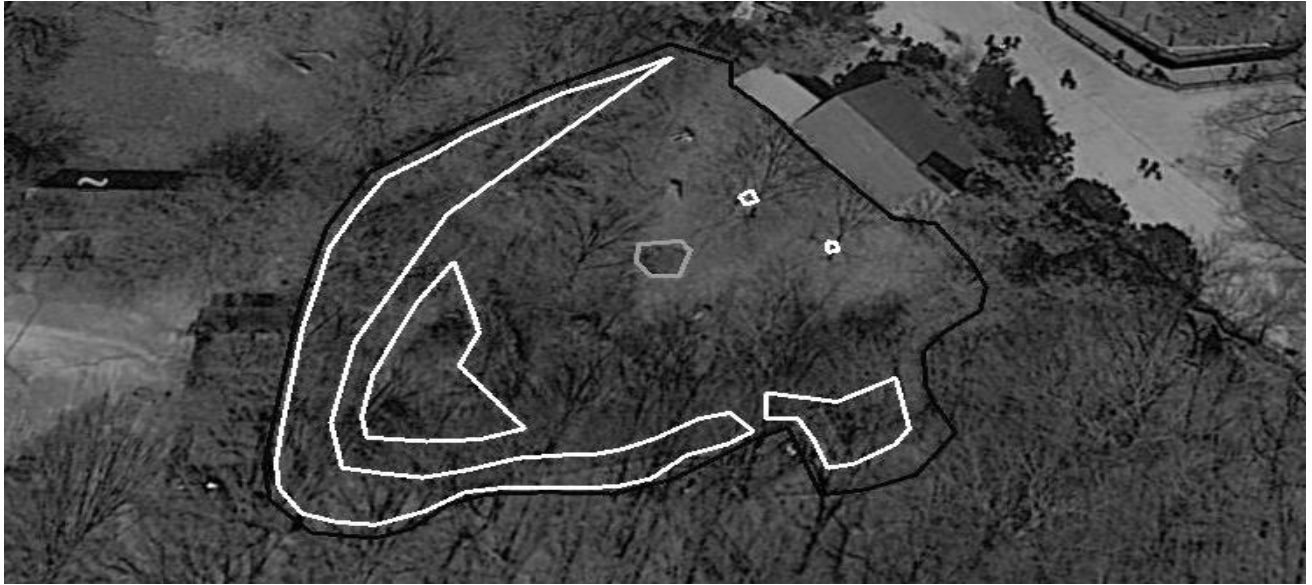


Figure 2. Milwaukee County Zoo Milwaukee Wisconsin; grey wolf exhibit. Key: Black-exhibit border (Total area= $1,350.14 \text{ m}^2$ ), White-tree cover ( $382.72 \text{ m}^2$ ), Grey-water source ( $8.28 \text{ m}^2$ ).  
Open area ( $959.14 \text{ m}^2$ )

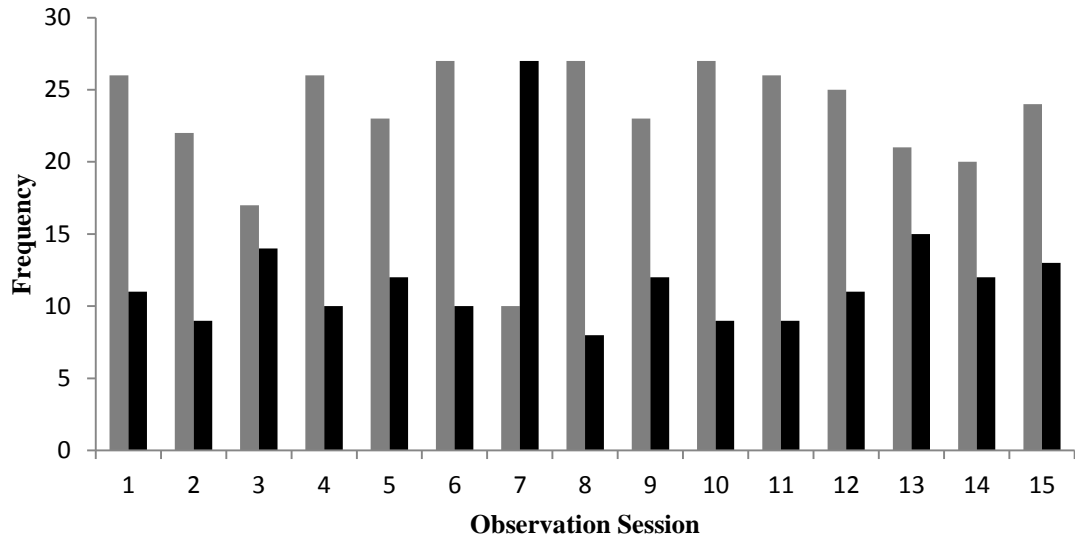


Figure 3. Frequency of active and non-active behavior totals per observation session at Menominee Park Zoo from October 2014 to January 2015. Active behaviors represented in grey and non-active in black. The active and non-active behaviors of each wolf were totaled, indicating no overall change in activity over the course of the study.



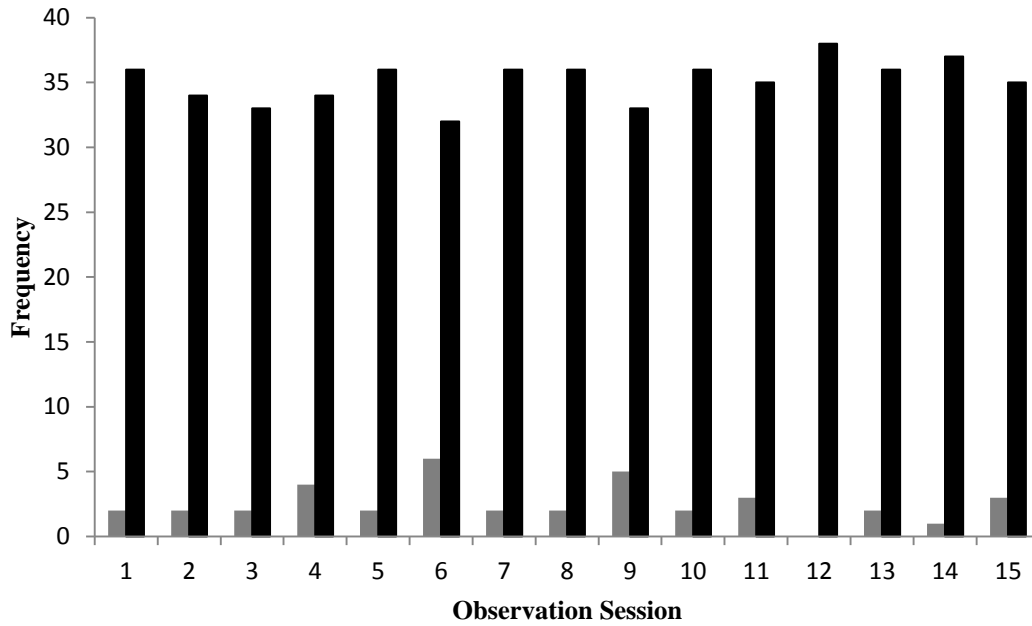


Figure 4. Frequency of active and non-active behavior totals per observation session at Milwaukee County Zoo from September 2014 to January 2015. Active behaviors represented in grey and non-active in black. The active and non-active behaviors of each wolf were totaled, indicating no overall change in activity over the course of the study.

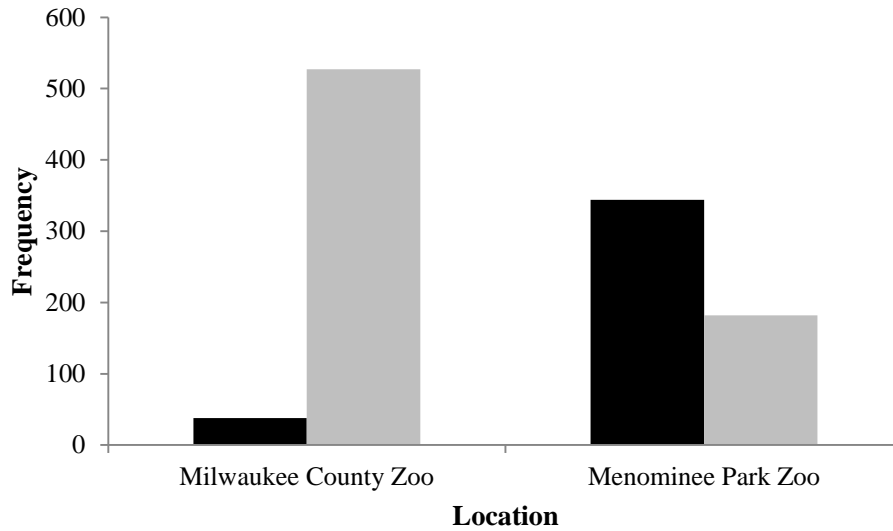


Figure 5. Comparison of total active and non-active behaviors from both wolf packs over the course of the study. The black bars represent the frequency of active behaviors and the grey bars represent non-active behaviors. Both active and non-active behaviors from the entire course of the study were totaled and compared between the locations. Milwaukee County Zoo shows a greater overall frequency of non-active behaviors while Menominee Park Zoo shows a greater overall frequency of active behaviors.

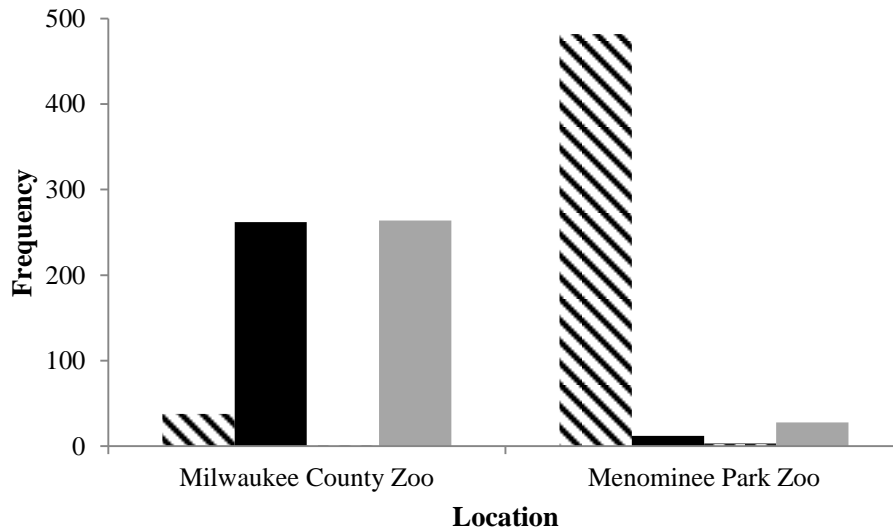


Figure 6. Comparison of exhibit use between both wolf packs over the course of this study. Open area is represented in diagonal stripes, tree cover in black, water source in checkered pattern, and den use in grey. This graph is showing the total frequency of use of each exhibit feature compared between each location and suggests significant differences in exhibit use patterns between the two observed wolf packs.