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A study of social rank development in captive African painted dog (*Lycaon pictus*) pups

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A study of social rank development in captive African painted dog (*Lycaon pictus*) pups

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Abstract

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ABSTRACT:

African painted dogs, *Lycaon pictus*, are an endangered social carnivore native to sub-Saharan Africa. Their historic range and population densities have been reduced due to habitat fragmentation, conflict with humans, and infectious disease. Captive populations of African painted dogs are found worldwide and are maintained in social groups to encourage natural pack behaviors. Specifically, Association of Zoos and Aquariums (AZA) populations are managed by Species Survival Plans. The foci of species management in these zoos are to maintain genetic diversity, promote species-specific social behavior, and maintain a self-sustaining population. Challenges faced by zoos include failed breeding recommendations, variable litter sizes, and pack instability due to the complexity of social dynamics. Minimal research efforts have focused on captive African painted dogs. Although the species currently is self-sustaining in captivity, some packs are unstable, displaying injurious aggression, failure to reproduce, or failure to raise offspring. Thus, there is a need to better understand how to form new packs, so that welfare and reproductive success are improved. The goal of my research was to determine methods that can be used to evaluate social rank within a litter of African painted dog pups. This included

evaluations of behaviors displayed by individuals as well as interactions between conspecifics. I also explored ways zoo care staff could assess individuals for transfer recommendations to a different facility. I performed this study on a litter of African painted dog pups at the Oklahoma City Zoo. I used focal observations to assess individual behaviors based on an African painted dog ethogram. Novel object presentations were used to assess responses on a bold/shy continuum. Latency to approach, first to approach, and other occurrences were documented during novel object presentations. There were significant differences among pups for the observed behaviors. Although there were no differences for submissive behaviors, there were differences among pups for dominant behaviors. There also were significant differences among pups for first to approach, as well as differences in latency to approach novel objects based on pack composition and type of object. F-flat was the subject that displayed the most first approaches and the most dominant behaviors. There were differences between behaviors of interest among individuals, but my data was insufficient for determining social rank. After evaluating the results of each observational method, the method that zoo care staff could most easily utilize would be novel object presentations. My study represents a preliminary analysis of social pack dynamics in captive populations. Further research recommendations include further defined behaviors of interests, and evaluation of the social ranks over time through changes in pack composition. For conservation efforts by zoos to continue successfully, it is essential to gain as much understanding as possible of the social structure and social development of captive-housed African painted dogs.

Introduction

The African painted dog (APD), *Lycaon pictus*, is a social carnivore native to sub-Saharan Africa. APDs are the only extant member of the genus *Lycaon*, and currently are endangered (Vucetich and Creel, 1999; Woodroffe and Sillero-Zubiri, 2012). Historically, this species was distributed throughout all of sub-Saharan Africa, and utilized a wide range of habitats. APDs have been found inhabiting grassy plains, semi-deserts, bushy savannas, and upland forests. They are habitat generalists but often prefer habitats with thicker bushes for cover. Current distribution of APDs is fragmented across southern Africa and a southern portion of east Africa. Their current range has been greatly reduced over the years due to habitat fragmentation, conflict with humans, and infectious disease (Woodroffe and Sillero-Zubiri, 2012). However, present ranges of APDs are limited primarily by human encroachment and prey availability rather than loss of habitat. Human conflicts include accidental snaring, road accidents, and deliberate killing of these dogs because they are considered a threat to livestock (Woodroffe et al., 2007). Diseases that impact populations include rabies, canine distemper virus, and canine parvovirus. Many factors increase the exposure to and transmission rate of infectious disease in APDs, such as sociality, competition with other wild carnivores, and close interactions with domestic dogs (Woodroffe et al., 2004).

APDs are pack animals. Pack sizes range from 2 to 40+ members (Mills, 1993; Creel and Creel, 2002), but the average is 6-17 members (Fuller et al., 1992). The complexity of APD cooperative behaviors are unique among group living canids (McCreery, 2000; Creel and Creel, 2002; Spiering et al., 2010). APDs are cooperative breeders and hunters. The packs function as structured social units, where pack members perform daily tasks cooperatively and together as a group (McCreery, 2000; Spiering et al., 2010). In comparison to smaller packs, larger packs tend

to be more successful at hunting and raising offspring, primarily due to the increase in available hunters and pup caretakers (Creel and Creel, 2002). APDs have large home ranges in comparison to other canids, estimated to be as large as 1,500-2,000 km^2 (Frame et al., 1979; Creel and Creel, 2002). APDs are primarily nomadic, unless they have pups (Frame et al., 1979). APDs are diurnal, with crepuscular activity patterns, including social activities and hunting primarily occurring at dawn and dusk (Fuller and Kat, 1990; Saleni et al., 2007).

Pack dynamics include a ranking system, with separate ranks for males and females (Creel and Creel, 2002). The alpha female is often the oldest, whereas the age of the alpha male is more variable (Creel and Creel, 2002; Spiering et al., 2010). Alpha pairs have been observed to tandem scent mark, meaning the alpha male marks (urinates) over the alpha female's mark (Frame et al., 1979; Jordan et al., 2014). Alpha pairs also are observed as the only individuals to urinate consistently with a lifted hind leg, instead of squatting (Malcolm and Marten, 1982). When protecting the pack, alpha individuals more commonly chase away predators from the den site than subordinate individuals (Malcolm and Marten, 1982).

Packs are composed of a breeding alpha pair, which is an unrelated male and female, and subordinate individuals, which are often relatives to one or both of the alphas (Girman et al., 1997; Courchamp et al., 2002). Although the alpha pair are often the only individuals who produce viable offspring, all members participate cooperatively in raising and taking care of individuals of the pack (Creel and Creel, 2002; Spiering et al., 2010). In the wild, the average litter size is 7-15 pups; however, in captivity the average litter size is 4-8 pups (Fuller et al., 1992). Subordinates have been known to reproduce in the wild and in captivity, but it is not clear how often this occurs or if subordinate litters survive due to the lack of observations and genetic evaluations (Spiering et al., 2010).

Breeding occurs annually. Pups begin to leave the den around three to four weeks of age (Malcolm and Marten, 1982; McNutt and Silk, 2008; Gusset and Macdonald, 2010). Pups are weaned around three months old. They depend on older pack members to provide them with meat from kills through regurgitations and to lead them to kills until they are 12 months old (Frame et al., 1979; Malcolm and Marten, 1982). At kills, pups and younger individuals have priority access to the meat (Malcolm and Marten, 1982; Creel and Creel, 1995). In the wild, potential alphas are often the first individuals of the litter to emerge from the den, have bolder personalities, and are the first to join the adults on hunts (G. Rasmussen, pers. comm.).

APDs typically display more affiliative and submissive behavior patterns according to rank, whereas aggression is generally uncommon (Creel et al., 1997; McCreery, 2000). At times younger male individuals may display aggressive behaviors toward the alpha male; however, aggression has been observed more often during mating periods, when competition for reproduction can occur, between individuals of the same sex (Creel et al., 1997). Usually the behaviors displayed between conspecifics are passive submission, such as rolling on the back to expose the belly, lower postures when greeting, and licking the sides of another individual's mouth (Schenkel, 1967; de Villiers et al., 2003). Social distance also is informative of pack structure; bonds between pack members often are displayed by contact or proximate spatial arrangement during resting periods (de Villiers et al., 2003).

Not only are APDs known for their complex social dynamics, but also for their distinct vocalizations (Robbins, 2000). Inter- and intra-pack communication is accomplished by a series of vocalizations. These vocalizations are unique to APD and are described as more bird-like than other canid species (Robbins, 2000). Vocalizations accompany most social interactions, with the most common vocalization being repetitive whimpers (Robbins, 2000). Specific pack call

vocalizations are rarely heard because they typically are issued only when two separate packs meet and shortly after separation. APDs packs avoid each other to prevent competition for resources. Thus, pack calls advertise location to other packs and reaffirm intra-pack bonds (Robbins, 2000).

Dispersal from natal packs occurs in both sexes to avoid inbreeding and intra-pack conflicts. APDs will disperse, at around 2-3 years of age, with same sex siblings and rarely disperse alone (McNutt, 1996). Males will disperse with each other to establish new packs elsewhere, but they often stay longer in their natal pack than females. Females disperse earlier to improve their chances of producing offspring (McNutt, 1996; Girman et al., 1997). When unfamiliar males and females meet, they either form a new pack or continue to search for new pack members (McCreery, 2000). Voluntary dispersal is not an option in captive populations; therefore, artificial selection of individuals to form packs has to occur to replicate natural pack structure. Artificial formation of packs does not allow individuals to select members for their new pack. Rather these decisions are made according to genetic compatibility, institutional space availability, and changing pack dynamics (Quick et al., 2017).

Captive populations of APDs exist worldwide, with approximately 30 packs housed in Association of Zoos and Aquariums (AZA) facilities (Mechak et al., 2016). APDs have been in AZA facilities since 1955. APD population growth has been inconsistent throughout most of their captive history. The population remained below 30 individuals until the early 1980s, when the population size doubled due to increased breeding rates, imports, and an increase in surviving offspring (Mechak et al., 2016; Quick et al., 2017). Since the 1980s, the population has displayed an overall trend of increasing growth, with a record number of 143 individuals in 2016 (Quick et al., 2017).

AZA facilities use Species Survival Plans (SSPs) to cooperatively manage captive breeding programs. Management strategies for breeding recommendations are based on maintaining genetic diversity, promoting species-specific social behavior, and maintaining a self-sustaining population (Potgieter et al., 2015; Quick et al., 2017). Current issues that arise from breeding/transfer recommendations are failed breeding attempts, variable litter sizes, high infant mortality, and pack instability due to the complexity of social dynamics. Institutions that are recommended to breed are expected to keep the offspring for two years to help replicate the natural social structure of multigenerational packs (Quick et al., 2017). Aggression is more common in captivity, due to the inhibition of voluntary dispersal if conflict arises, especially when competing for a mate. In stable groups of wild APDs, most disputes are handled with mild aggressive displays, whereas injurious aggression has been observed in unstable (often recently formed) groups (Creel et al., 1997).

The main constraint on multigenerational packs in zoos is the potential for inbreeding or group conflict resulting from the lack of voluntary dispersal (Creel et al., 1997; AZA Canid TAG, 2012). When managing zoo populations, young individuals, once old enough, are relocated to different zoos and females and males are distributed separately to aid in maintaining genetic diversity and to mimic natural dispersal patterns (Potgieter et al., 2015). The optimal social structure for captive APDs are a male-female pair with female pups less than two years of age, and male offspring of any age (AZA Canid TAG, 2012). Males are often kept with their natal pack unless needed for reproduction or new same-sex packs are needed for exhibition at other zoos. The preferred social group is not always feasible; alternatives include grouping litter mates, or creating same-sex packs of related or unrelated individuals (AZA Canid TAG, 2012). The average pack size of adults in AZA institutions is 2-5 individuals (Quick et al., 2017). In

captivity, smaller packs are preferred to reduce inbreeding and aggression related to mating (Creel et al., 1997; AZA Canid TAG, 2012; Quick et al., 2017). Current captive population numbers are stable, but could decline if there is an increase in unstable packs (Mechak et al., 2016).

The limited research on APDs primarily focuses on wild populations with minimal research efforts focused on captive populations. Genetic management of captive populations has been the focus to assure population success. The next step to improve the welfare and reproductive success of this species in captivity is to address and understand social dynamics of artificially formed packs. As individuals are moved among zoos, it is essential to understand each individual's social rank to allow for greater success in pack formation to manage all APDs in zoos as a metapopulation.

The overall objectives of my study were to provide insight about social structure of captive APD packs, explore methods that care staff could utilize to evaluate rank, and determine if there are behaviors in APD puppies that designate rank. My study was preliminary and exploratory; therefore, my study was not hypothesis driven. The focus was to evaluate individual behaviors and interactions between conspecifics, and determine which specific behaviors designate social status. My study will improve the management and decision-making processes used when forming artificial packs in captivity and will assist in determining the most effective way for care staff to objectively assess individuals for relocation recommendations.

Methods

The University of Central Oklahoma Institutional Animal Care and Use Committee (IACUC) reviewed and approved the procedures used in this study (Application #16015). My study was conducted at the Oklahoma City Zoo and Botanical Gardens (OKC Zoo) main African painted dog exhibit in Oklahoma City, OK [USA]. OKC Zoo's Scientific Review Committee also approved this research.

Housing

The main OKC Zoo APD exhibit was approximately 1100 m^2 in size (Appendix 1). The exhibit contained a water pool, trees, logs, rocks, and a natural dirt and grass substrate. A second adjacent exhibit of equal size with similar vegetation was used to separate pack subsets prior to transfer to another zoo. There was a holding area, approximately 65 m^2, with shifting doors between the two exhibit sites. All holding areas and exhibit space for APD at OKC Zoo are outside; there are two artificial den boxes and a barn that the animals have access to overnight, during inclement weather, and during the birth season. I only conducted observations when the subjects were in the main exhibit enclosure. Animals were shifted into the holding area when care staff were cleaning, and the animals had access to this area when the zoo was not open to the public from 1700 to 0900 the following day.

Subjects

Study subjects were 12 (3 females, 9 males) captive African painted dog pups born on November 17, 2016. The other pack members included an alpha female (birthdate: 1/13/11) and male (birthdate: 11/23/11), a subordinate adult male (birthdate: 11/23/11), and eight yearlings (4 females, 4 males; birthdate: 10/4/15). My focus was on the development of social relations

among the pups, and thus direct observations of adults and yearlings were not recorded. I identified individuals by markings on their fur. Individual pictures taken on three occasions, helped identify individuals throughout the study (Appendix 2). Each individual had an assigned name to aid in identification (Table 1). The pups were under a year old at the time of this study. During this study, the three female pups were separated from the rest of the pack on July 19, 2017, to be relocated to another zoo. I did not evaluate the observational data as pre- and post-separation, because males and females have separate ranks (Creel and Creel, 2002).

Table 1. Names and sexes of African painted dog pups observed at the Oklahoma City Zoo.

Sex	Name
Female	Tri
	Last
	Socks
Male	Tex
	Swiss
	Wishbone
	Tally
	Spot
	Echo
	F-Flat
	Monkey
	Seuss

Focal observations

I collected behavioral data using focal sampling from May through September 2017. I chose the time of day based on keeper feedback and preliminary observations. Observation sessions occurred at 1030 each day, three times a week. I used one primary public viewing area of the main exhibit for observations. During each session, I documented weather, temperature, keeper presence, and other notable occurrences. Preliminary observations of the pack led to the determination of the length of focal observations. I used a focal sampling approach for observations. Focal sampling is recording observations on one individual for a specific amount of time while recording predefined behaviors based on specific sampling methods (Martin and Bateson, 1993). During each session, I chose focal individuals at random, and observed each individual pup for five minutes per session, with one-minute intervals until I observed all individuals. My focal observations included mixed recording methods: all-occurrence and instantaneous (Appendix 3). All-occurrence recording, or continuous sampling, is recording each

occurrence of the predefined behaviors of interest (Martin and Bateson, 1993). Instantaneous recording is a form of time sampling that records predefined state behaviors at specific short sample intervals, each sample interval results in a sample point of data (Martin and Bateson, 1993). For example, my full focal observations were five minutes in length, with one-minute sample intervals; this gives five sample points of data per individual per session. I used an ethogram when evaluating behaviors among individuals in the pack; specific behaviors of interest were recorded based on sampling method. I constructed the ethogram (Table 2) based on ethograms provided by the Vice-Chair of the APD SSP and modified canid behavior definitions from van der Borg et al. (2015). I recorded the frequency of nine behaviors using all-occurrence recording (AO). The AO behaviors included *bite, stalking, begging, flee, chase, scent marking, rolling on back to expose belly, following,* and *leading*. Any behavior that I recorded using AO recording had to cease for at least five seconds or be interrupted by another behavior before it was recorded again. State behaviors performed by the pups were recorded using instantaneous recording (IS) at one-minute interval. Instantaneous behaviors included *investigate, stationary alert, feed/forage, play, inactive, other social agonistic, other social affiliative, solitary,* and *not visible*. I also recorded social distance from any conspecifics at each one-minute interval; nearest neighbor was not recorded. I used adult body length, without tail, to categorize distance from conspecifics into five categories: *contact, proximate, out of reach, distant,* and *not visible*. I defined *contact* as subject touching a conspecific, *proximate* as subject within one adult body length of a conspecific, *out of reach* as subject more than one body length of a conspecific, *distant* as subject more than three adult body lengths from a conspecific. When the distance could not be determined between subjects, I defined it as *not visible* (Table 2).

Table 2. African painted dog ethogram used for focal observations from May through September 2017. Recording method used for each behavior is listed as (IS) for instantaneous and (AO) for all-occurrence. Initiator and recipient were not recorded for these behaviors.

Behavior	Code	Sampling Method	Definition
Bite	BI	AO	Taking any part of recipient's body between the jaws with sufficient pressure that could cause injury for more than 2 seconds.
Stalking	ST	AO	Walk or run toward another individual over a distance of 3 meters. Ears back and head down.
Scent marking	SM	AO	Urinating by squatting or lifting a rear leg.
Rolling on back to expose belly	RB	AO	Roll over onto back to show belly to other individual.
Flee	FL	AO	Running away from initiator over a distance of 3 meters or more with head in opposite direction of initiator.
Chase	CH	AO	Running after another individual covering a distance of 3 meters or more with head toward recipient.
Begging	BE	AO	Licking lips of adult – usually during or after a meal.
Leading	LD	AO	One individual is followed by one or more individuals around the enclosure. Must occur for more than 5 seconds, no object present. *not a run.
Following	FO	AO	One individual is clearly following a conspecific around the enclosure. Must occur for more than 5 seconds, no object present. *not a run.
Investigate	IN	IS	Movement around enclosure. Exploring non-food objects; approaching the object or interacting with the object – sniffing, licking, moving object.
Stationary alert	SA	IS	Alert, standing, sitting or lying quietly in one location, but remaining attentive, moving head from side to side and/or sniffing air, perhaps attending to external stimuli. Simply opening the eyes and/or shifting position while resting does not apply.
Feed/Forage	FF	IS	Ingesting a food item or searching for food items.
Play	PL	IS	A behavior that appears to be purposeless and non-aggressive: Social or independent.
Inactive	IA	IS	Sleeping, laying down, unresponsive to the surrounding environment with eyes open or closed.
Other social agonistic	OAG	IS	Any other agonistic/aggressive social interaction not defined above.
Other social affiliative	OAF	IS	Any other affiliative social interaction not defined above.
Solitary	SOL	IS	Any solitary behavior not defined above.
Not Visible	NV	IS	Pup out of sight or behavior cannot be clearly seen.
Social Distance – measured in full adult body lengths			
Contact	C	IS	Touching another individual.
Proximate	P	IS	Within one adult body length of another individual.
Out of Reach	O	IS	More than one adult body length from another individual.
Distant	D	IS	More than three adult body lengths away from another individual.
Not Visible	NV	IS	Distance between dogs cannot be determined.

Novel object presentation

I began novel object (NO) presentations when pups were eight weeks old (January 2017); and I collected data from January through September 2017. Time of day was chosen based on keeper availability. NO presentations occurred once a week, at the same time of day 1330, and were video recorded for further examination. All objects I used in this study were approved by OKC Zoo's veterinarian and UCO's IACUC (Application #16015.02). Objects included food items, objects commonly used in zoos for enrichment, and other creative object presentations (Appendix 4). For each NO session, I documented novel object, type of presentation, latency to interact with the object, first pup to contact the object, and interactions among pups. The objects were presented to the pups in various ways. OKC Zookeepers tossed, hung, or placed the objects in the exhibit. For objects that were placed or hung in the exhibit, keepers shifted out all dogs in that part of the enclosure, placed the object, and then released the dogs at the same time to interact with the object.

In each session, I documented how long it took for one of the pups to touch the object (i.e., latency to approach). I determined the latency to approach by video review and recorded it in seconds. Due to the variability in object presentation, time began either when the dogs were released from the holding area, or when the item hit the ground, (i.e., tossed items). For comparison, I also documented latency to approach for the other pack members, which are referred to as adults but also include the yearlings from the previous litter in some instances.

First pup to interact with object (take, sniff, investigate, etc.) was documented visually and followed up with video review. I documented when more than one individual was the first to interact as simultaneous first interaction. Ordering the individual interactions as first, second, third, and so on, with the object was not feasible due to visual obstructions. Therefore, any pups

interacting with the object after the first pup were simply documented as having interacted with the object. If some subjects were not present to interact with the object (i.e., some subjects in den when presentation occurred) that presentation was excluded from the analysis. Since I was interested in the initial response to the object, video recording ended when pups ceased interacting with the object for more than 10 minutes.

Statistical analysis - Focal observations

I documented all focal observation sessions on paper during the focal observation and then later entered data into a Microsoft® Excel spreadsheet. No inter-observer reliability was assessed because I was the only observer, however I did assess intra-observer reliability. For this, I measured the same video sample of behaviors on three occasions throughout the study, in April 2017, June 2017, and August 2017. Reliability was measured using a Pearson Correlation Test of the beginning (April) and end (August) samples. My intra-observer reliability measurements resulted in a Pearson Correlation of $r = 0.96$, and thus exceeded the acceptable measure of 0.70 provided by Martin and Bateson (1993).

I categorized instantaneous behaviors into *active* and *inactive* behaviors. *Inactive* behaviors included *stationary alert* and *inactive*. *Active* behaviors included *play, investigate, feed/forage, other social affiliative, solitary,* and *other social agonistic*. I converted sample point data per individual into percentage of time spent performing each behavior. For each individual, each sample point total was divided by the total number of intervals for all focal observations, and then multiplied by 100 to obtain the percentage of time. Since the method of instantaneous recording did not record duration of the behavior performed, these percentages are a reasonably close approximation of the amount of time they spent performing the behavior of interest. I used social distance data to determine percentage of time each individual spent in each distance

category. I categorized all-occurrence behaviors into *submissive* and *dominant* behaviors. *Submissive* behaviors included *begging, flee, rolling on back to expose belly,* and *following*. *Dominant* behaviors included *bite, stalking, chase, scent marking,* and *leading*. I converted all-occurrence behaviors into a rate of frequency per time. To test for differences among subjects for active, inactive, distance, and AO behaviors, I used Microsoft® Excel (2016) to perform a Chi-square Goodness of Fit Analysis on the discrete data. To determine if there was a relationship between behavior observed and individual, I used IBM® SPSS version 24 (2016) to perform a Log Likelihood Contingency Test on the discrete data. I used an α of 0.05 for all statistical tests.

Statistical analysis - Novel object presentations

I calculated range, mean, and standard deviation to describe latency to approach. I used Microsoft® Excel (2016) to perform an Independent T-Test to test the hypothesis that mean adult latencies were shorter than puppy latencies. I used three separate Kruskal-Wallis H Tests to determine differences of latency for the puppies to approach objects based on pack size, type of presentation (placed, tossed, or hung), and type of object (food in addition to an object, only food, and non-food objects). In instances in which the puppies were split into two packs (i.e., after the female puppies were separated from the pack before transfer to another zoo), latencies were averaged for all puppies and analyzed by type of presentation, and type of objects. However, latencies for the two packs were analyzed separately when evaluating latency to approach based on pack size. To determine differences among subjects for the total number of first contact with the objects, I used Microsoft® Excel (2016) to perform a Chi-square Goodness of Fit Analysis on the discrete data.

Results

I conducted 46 focal observation sessions, resulting in 230 sample points or 230 minutes of data for each subject, which is 2,760 minutes of behavioral data total for all subjects.

Instantaneous behaviors

Time spent *active*, *inactive*, and *not visible*, averaged across all subjects was 22.9%, 59.2%, and 17.9%, respectively (Figure 1). *Stationary alert* and *inactive* were the most commonly observed behaviors, 31.41% and 27.83%, respectively. *Play* and *investigate* instantaneous behaviors were the most commonly observed *active* behaviors, 9.20% and 8.88%, respectively (Table 3). The individual displaying the most *active* behaviors was Spot (male), who displayed 28.7% of active behaviors. The individual displaying the least amount of *active* behaviors was Echo (male), who displayed 16.5% of active behaviors. The subject that displayed the most inactive behaviors was Socks (female), who displayed 73.0% of inactive behaviors. The individual with the least amount of inactive behaviors was Monkey (male), who displayed 50.0% of inactive behaviors (Figure 2). Interval totals for *active* behaviors were significantly different among subjects, while *inactive* behaviors were not significantly different among subjects (Chi Square Goodness of Fit; p=0.03 and p=0.05, respectively).

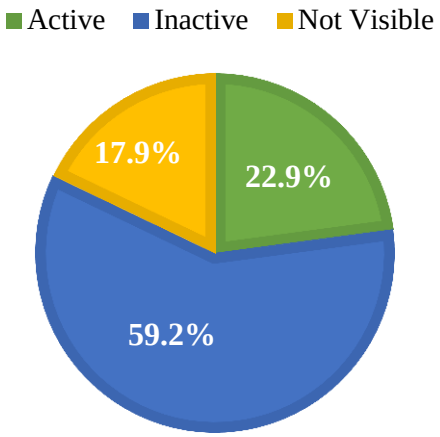

Figure 1. Average percentage of time subjects were *active*, *inactive*, and *not visible* during observations from May through September 2017.

Table 3. Classification of instantaneous behaviors and average percentage of time all African painted dog pups in the Oklahoma City Zoo study pack displayed these behaviors during observations from May through September 2017.

Instantaneous Behaviors	Classification	Average Time (%)
Stationary alert	Inactive	31.41
Inactive	Inactive	27.83
Not visible	Not visible	17.86
Play	Active	9.20
Investigate	Active	8.88
Feed/forage	Active	3.91
Other social affiliative	Active	0.60
Solitary	Active	0.29
Other social agonistic	Active	0.04

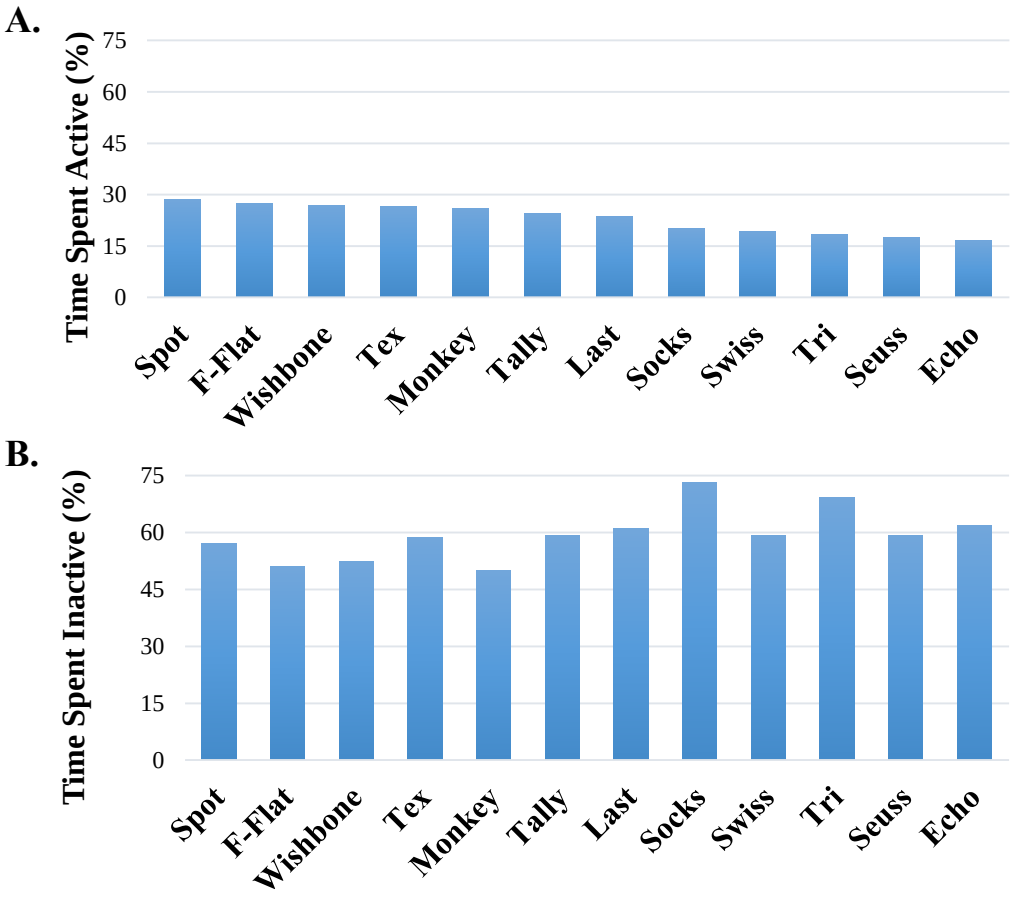

Figure 2. Percentage of time each individual African painted dog pup in the Oklahoma City Zoo study pack was *active* (A) and *inactive* (B) during observations from May through September 2017.

Average time spent *not visible*, *contact*, *proximate*, *out of reach*, and *distant* from other individuals were 19.4%, 12.8%, 48.7%. 10.4%, and 8.7%, respectively (Figure 3). On average, subjects spent the majority (48.7%) of their time *proximate* to other individuals, while only 8.7% of their time was spent *distant* from other individuals. Time spent *distant* was found to be significantly different among subjects when evaluating interval totals (Chi Square Goodness of Fit; $p<0.001$). Tri (female) and Last (female) were the two subjects that spent the most amount of time *distant*. Wishbone (male) and Seuss (male) were the two subjects that spent the least amount of time *distant* (Figure 4).

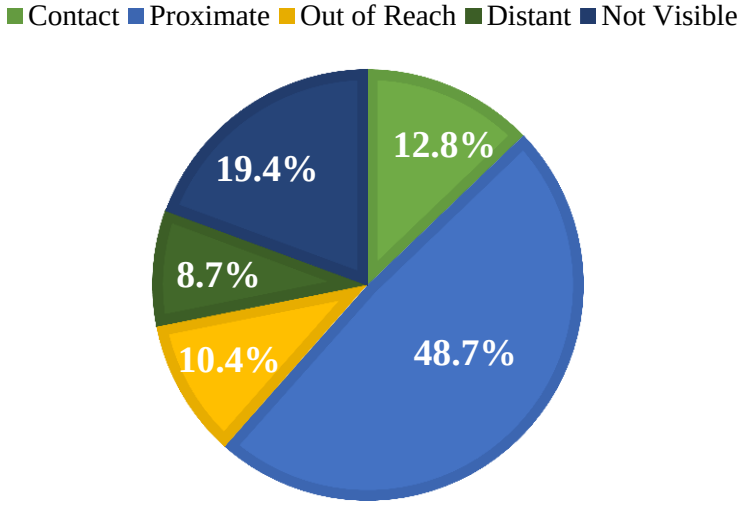

Figure 3. Average percentage of time all African painted dog pups in the OKC Zoo study pack spent in each social distance during observations from May through September 2017.

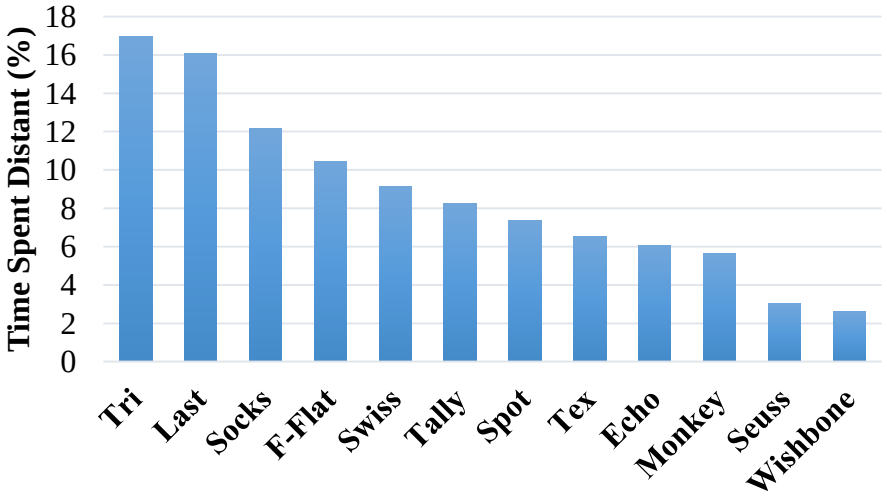

Figure 4. Percentage of time African painted dog pups in the Oklahoma City Zoo study pack spent *distant* (more than three adult body lengths) from conspecifics from May through September 2017.

All-occurrence behaviors

I observed eight of the nine all-occurrence behaviors during focal observations. *Scent marking* was never observed (Table 4). Last and F-Flat were the two subjects with the most occurrences (rate of 0.217) of observed all-occurrence behaviors. Seuss was the individual with the least occurrences (rate of 0.078) of observed all-occurrence behaviors (Figure 5). Frequencies of all-occurrence behaviors was different among subjects (Chi Square Goodness of Fit; $p<0.001$). AO behaviors also were different among females inclusively and among males inclusively (Chi Square Goodness of Fit; $p<0.001$). There was no relationship between individual and behavior observed (Log Likelihood Contingency; $p=0.069$).

Table 4. All-occurrence (AO) behavior rates on average for all African painted dog pups in the Oklahoma City Zoo study pack during observations from May through September 2017. Time is total minutes (2,760).

AO Behavior	Average Rate (Frequency per time)
Bite	0.047
Following	0.029
Chase	0.019
Flee	0.017
Stalking	0.0094
Leading	0.0080
Rolling-onto back	0.0033
Begging	0.0014
Scent marking	0

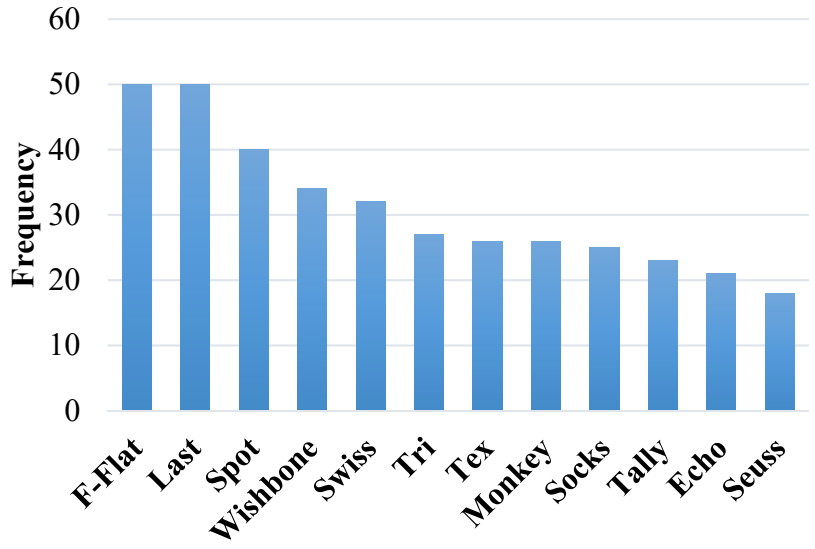

Figure 5. All-occurrence (AO) behavior frequencies for each African painted dog pup in the Oklahoma City Zoo study pack during observations from May through September 2017 (out of a sum of 372 observed behaviors).

After categorizing behaviors into *submissive* and *dominant* behaviors, there were differences among subjects for *dominant* behaviors but no differences among subjects for *submissive* behaviors (Figure 6; Chi-Square Goodness of Fit; $p<0.001$, $p=0.27$, respectively).

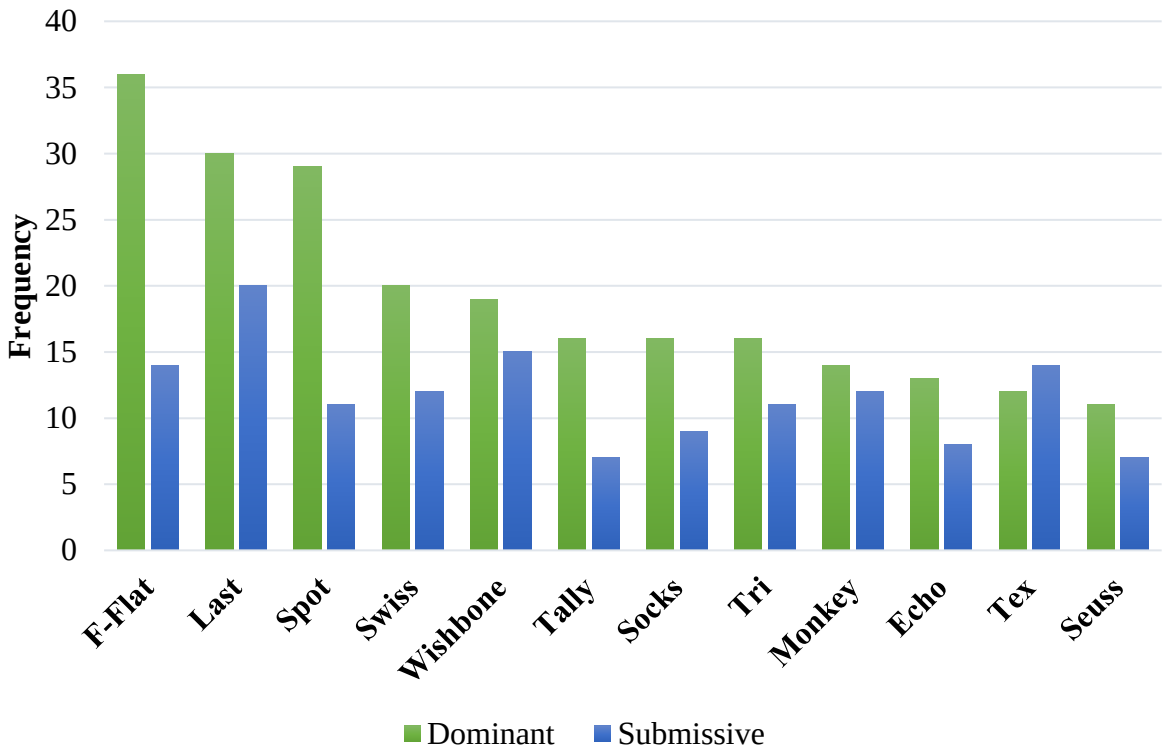

Figure 6. All-occurrence (AO) behavior frequencies categorized into *submissive* and *dominant* behaviors for each African painted dog pup in the Oklahoma City Zoo study pack during observations from May through September 2017 (out of a sum of 372 observed behaviors).

Novel object presentations

I evaluated 31 novel object presentations. All object presentations were included in the calculation and adult versus puppy comparison of latencies to approach the objects. I excluded five presentations from the evaluation of which subjects approached the object first, due to difficulty identifying subjects, and excluded one presentation because only two pups were in the enclosure at the time of the presentation. Pack composition changed during the course of this study; separations for prospective relocations occurred on multiple occasions. Yearlings were separated from the pack in April 2017, and the female pups were separated in July 2017. Due to this, I grouped the object presentations into three groups based on pack composition. *Group one* included the whole pack: three adults, eight yearlings, and twelve pups. *Group two* included three adults and twelve pups. *Group three* included two separate packs: one with three female pups, and one with three adults and nine male pups (Table 5).

Table 5. African painted dog novel object presentations performed January through September 2017 categorized into groups based on pack composition. Four female yearlings were separated after the first six novel object presentations.

Group	Pack Composition	Number of Individuals	Age of puppies (months)	Number of Novel Object Presentations
1	Multigenerational (adults, yearlings, pups)	19-23	1.7-4	13
2	Pack excluding yearlings (adults and pups)	15	5-8.5	11
3	Two separate packs (male pups with adults, and female pups alone)	12, 3	8.5-10	7

Object presentations were categorized into pack composition, type of presentation (placed, tossed, or hanging), and type of object (food in addition to an object, only food, and

non-food objects). Average latency to approach for all novel object presentations for adults (adults or yearlings), was 9.9 seconds when the yearlings were present, and 14.8 seconds after the yearlings were separated (*groups two* and *three* were combined for adult averages). Average latency to approach the objects for the pups in *group one* and *two* was 108.5 seconds. In *group three*, after the females were separated, latency to approach was 12.8 seconds for the male pups and 80.9 seconds for the female pups (Table 6). Two extreme outliers skewed the results. Pups took 1140 seconds to approach cardboard boxes at seven weeks old and 1126 seconds to approach a floating plastic iceberg in the pool at four months old. For comparison, the other objects ranged from 1.2-122 seconds. Mean adult latency to approach the objects was significantly shorter than mean puppies' latency to approach the objects (Independent T-Test; $p=0.04$). Based on pack size, the puppies' latency to approach the objects was significantly different among each group of pack composition (Kruskal-Wallis H Test via Chi-Square; $p<0.05$).

Table 6. Latency to approach (seconds) novel objects for adults versus puppies in different African painted dog pack compositions for the Oklahoma City Zoo pack from January through September 2017.

Group	Number of Novel Object Presentations	Subjects	Mean Latencies (seconds) and Standard Deviation	Range
1	13	Adults	9.91 ± 13.02	1.1-43.7
		Puppies	214.28 ± 431.23	3.6-1226.0
2	11	Adults	19.99 ± 16.39	0.7-60.0
		Puppies	22.58 ± 32.98	1.2-122.0
3	7	Adults	9.72 ± 2.81	8.1-14.8
		Male Pups	12.84 ± 6.08	5.9-20.4
		Female Pups	80.90 ± 166.88	10.7-459.0

Type of presentation did not influence the amount of time it took for the pups to approach the object. There were 10 hanging, 9 tossed, and 12 placed object presentations. Latency to approach objects based on type of presentation was not found to be significantly different (Kruskal-Wallis H via Chi-Square; $p>0.05$). Average latency to approach for hanging objects was 39.8 seconds in *groups one* and *two*; in *group three*, it was 15.3 seconds for the male pups and 106.9 seconds for the female pups. Average latency to approach for tossed objects was 29.5 seconds for all pups (tossed objects did not occur in *group three*). Average latency to approach for placed objects was 257.0 seconds in *groups one* and *two*; in *group three*, it was 6.7 seconds for the male pups and 16.0 seconds for the female pups (Table 7).

Table 7. African painted dog adult, puppy, male puppy, and female puppy latencies (seconds) to approach each type of presentation of novel objects used at the Oklahoma City Zoo from January through September 2017.

Type of Object Presentation	Group	Number of Novel Object Presentations	Subjects	Mean Latencies (seconds) and Standard Deviation	Range (seconds)
Hanging	1 and 2	5	Adults	12.60 ± 6.71	7.7-60.0
			Puppies	39.82 ± 47.27	9.4-122.0
	3	5	Male Pups	15.32 ± 5.53	9.4-20.4
			Female Pups	106.88 ± 197.00	11.2-459.0
Thrown	1 and 2	9	Adults	8.08 ± 11.35	0.7-30.25
			Puppies	29.47 ± 33.20	1.2-108.0
Placed	1 and 2	10	Adults	18.25 ± 18.77	2.8-60.0
			Puppies	256.98 ± 489.00	6.0-1226.0
	3	2	Male Pups	6.65 ± 1.06	5.9-7.4
			Female Pups	15.95 ± 7.42	10.7-21.2

Type of object did influence the amount of time it took for the pups to approach it. There were 11 objects that had food in addition to the object, 10 food only objects, and 10 non-food

objects. Average latency to approach objects that had food in addition to the object was 198.4 seconds for the pups in *groups one* and *two*; in *group three*, it was 16.6 seconds for male pups and 130.8 seconds for female pups. Average latency to approach food only objects was 8.0 seconds for the pups in *groups one* and *two* (food only objects did not occur in *group three*). Average latency to approach non-food objects was 197.0 seconds for the pups in *groups one* and *two*; in *group three*, it was 6.7 seconds for male pups and 16.0 seconds for female pups (Table 8). Latency to approach novel objects based on type of object was found to be significantly different (Kruskal-Wallis H via Chi-Square; $p<0.001$).

Table 8. African painted dog adult, puppy, male puppy, and female puppy latencies (seconds) to approach each type of object used at the Oklahoma City Zoo from January through September 2017.

Type of Object	Group	Number of Novel Object Presentations	Subjects	Mean Latencies (seconds) and Standard Deviation	Range (seconds)
Food in addition to an object	1 and 2	7	Adults	13.06 ± 12.67	2.8-43.7
			Puppies	198.36 ± 416.94	15.1-1140
	3	4	Male Pups	16.60 ± 5.19	9.4-20.4
			Female Pups	130.80 ± 218.93	14-459
Only food objects	1 and 2	10	Adults	12.08 ± 9.64	0.7-30.25
			Puppies	8.00 ± 4.73	1.2-15.6
Non-food objects	1 and 2	8	Adults	15.07 ± 19.71	1.1-60
			Puppies	197.04 ± 416.83	23-1226
	3	2	Male Pups	6.65 ± 1.06	5.9-7.4
			Female Pups	15.95 ± 7.42	10.7-21.2

I evaluated 25 presentations for first contact with the object. On multiple occasions, more than one individual approached the item simultaneously. Due to this, I took into consideration

the number of times subjects approached the item alone (i.e., solo) and with others (i.e., simultaneous). All subjects contacted the object first at least once. F-Flat had the highest number of solo first contacts (eight objects), and the most simultaneous first contacts (eight objects). Four subjects (Echo, Seuss, Swiss, and Wishbone) only had simultaneous first contacts. The three females (Last, Socks, and Tri) did not show a difference in the number of times they approached the item first. Tri was the only individual who only contacted objects solo (Figure 7). There was a difference among subjects for the total number of first contact with the novel objects (Chi Square Goodness of Fit; $p<0.001$). Although there was no difference among females inclusively, there was a difference among males inclusively (Chi Square Goodness of Fit; $p=0.67$, $p<0.001$, respectively).

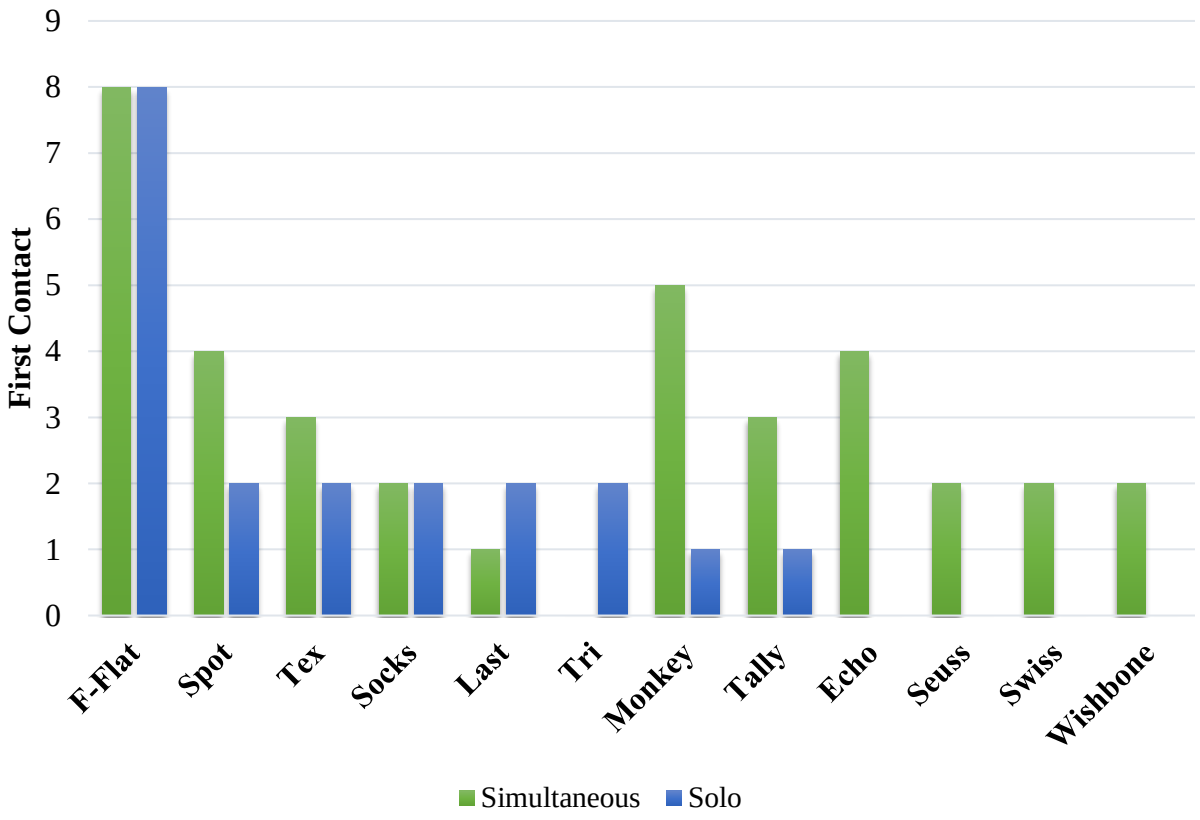

Figure 7. Number of times each African painted dog pup in the Oklahoma City Zoo study pack contacted the novel object first either alone (solo) or with others (simultaneous) during novel object presentations from January through September 2017.

Discussion

Activity among subjects

In preliminary observations, I often observed these subjects performing short bursts of activity followed by long periods of inactivity. The time of focal observations was determined based on preliminary observations and keeper feedback. Subjects were inactive during the majority of time during focal observations. It was not surprising that these subjects were largely inactive during the focal observations occurring at 1030, due to their primarily crepuscular activity patterns in the wild (Saleni et al., 2007). In another captive study on APD, social activity increased prior to feeding times in the afternoon, while during other times of the day they were primarily inactive (Tighe, 2013). It is recommended that further evaluations of social interactions should occur during the more active times of the day, such as early morning or late afternoon.

Social distance

Social distance data revealed that subjects spent only 8% of the time *distant* (more than three adult body lengths) from each other. I often observed pups lying in close proximity during the inactive portions of the focal observations. APDs typically spend the majority of their day resting, and often lie within one body length from other individuals of the pack as an act of passive interactions (Fuller and Kat, 1990; McCreery, 2000; Tighe, 2013). Although I did not document if certain subjects were repeatedly resting near the same individuals, the fact that the individuals in this study pack spent the majority of their time within one body length of another individual allows us to speculate that this pack is fairly stable socially. Proximate spatial associations often maintain social bonds and reinforce the pack structure (McCreery, 2000; de Villiers et al., 2003; Tighe, 2013). I would recommend that recording social distance is useful if

the identity of the subjects is also recorded to determine if certain subjects spent more or less time near each other.

All-occurrence behaviors

I did not record the length of AO behaviors; therefore, I cannot accurately report the percentage of time the subjects spent performing these all-occurrence behaviors. In a previous study on captive African painted dogs, Tighe (2013) observed that less than 1% of social interactions were dominant or submissive behaviors.

I limited the behaviors of interest to a variety of submissive and dominant behaviors commonly observed in canids. Variability in the broad definitions of the ethogram used in my study led to minimal conclusions about the differences in dominant behaviors. These subjects displayed more dominant behaviors than submissive, with the most commonly observed behavior being *bite*. *Bite* having a broad definition allows inclusion of play biting as well. Often times these puppies played rough, but further analysis should classify a *play bite* separate from an intentional *harmful bite*, and also include how the other individual responded to the bite or further details on the type of interaction that occurred (i.e., cooperative, agonistic, or affiliative). In animals, play behavior often is used to strengthen social bonds within a group (Bekoff, 2004). In other canids such as bush-dogs, it is believed that because they need to remain non-competitive during hunting, their object and social play reinforces submissive and cooperative behaviors (Kleiman, 2011). There is conflicting literature on social development in wild canids. Biben (1983) contends that no dominance relations develop during social interactions and play within bush dogs, crab-eating foxes, and maned wolves, but Bekoff (1978) observed early dominance and fighting interactions have an extended effect on social development in coyotes. Since these other canid species display different social systems, I suggest further longitudinal

evaluations of APD social development should be conducted to determine if early social interactions play a role in adult social rankings.

Begging was only observed four times in four different subjects. Begging is commonly observed in wild populations, often during greeting ceremonies and when soliciting food regurgitation (Estes and Goddard, 1967; Malcom and Marten, 1992). Tighe (2013) also did not commonly observe begging in a captive situation. It is hypothesized that captive individuals lack the need to beg due to being well fed and having direct access to food.

Scent marking was the only defined all-occurrence behavior not observed in the subjects, possibly due to their young age as well as a lack of need to scent mark. Scent marking often is used for defense displays and advertising mating availability such as pair bonding (Ralls, 1971; Jordan et al., 2014). As previously mentioned in the introduction, alpha pairs have been observed to tandem scent mark to display rank (Frame et al., 1979; Jordan et al., 2014). This study pack lacked the need to scent mark or advertise for mating because subjects were under a year old and lived with related females in the pack.

Latency to approach novel objects

I found that the type of object and pack composition influenced the amount of time it took subjects to approach novel objects. I did not find significant differences in latency to approach based on the type of presentation, which could be because adults were not present when the female puppies were separated into their own pack. The three female pups who made up the smaller pack, took longer to approach objects that were hanging compared to the objects that were placed on the ground. Similarly, in the larger pack of nine male puppies and three adults, it also took them longer to approach hanging objects than placed objects, but because an adult dog would often approach the item first, I believe it gave the puppies more confidence to

approach the object in less time. The type of object with the shortest latency to approach was food; however, when the presentation had food in addition to an object, it often took subjects longer to approach the object. I can speculate that food items took the least amount of time to approach because although it was not their main diet, it was an object that had an enticing smell. When the presentations had food in addition to an object, at times they would approach the food first before the object. I also can speculate that latency to approach was longer for hanging objects because the pack was rarely provided with hanging objects prior to this study. Hanging presentations were the most different and novel to this study pack. F-Flat was the individual who approached the most hanging objects first and alone (7 out of 10 hanging objects). Placed objects were the only objects that had simultaneous first approaches of more than one individual.

Novel object presentations

Some subjects consistently approached and touched the objects first, whereas some subjects only approached and touched the objects first simultaneously with other dogs. The subject who most often approached the objects first alone was also the individual that displayed the most all-occurrence behaviors, F-Flat. All three females (Tri, Last, and Spot) approached items alone the same amount of times. Of the female pups, Last displayed a greater amount of all-occurrence behaviors. This type of observational method has not been used to evaluate APDs social rank. Although I did not evaluate personality types, in another captive APD study that did focus on personality types and used Principal Component Analyses, they speculated that curious individuals are often middle- to lower-ranked pack members (O'Malley, 2013). Those curious individuals were characterized by *investigative, alert,* and *movement* behaviors. Further research should include a combination of novel object presentations and personality assessments to evaluate what rank the curious or bold individuals would be in their adult packs. This type of

presentation would be ideal for zoo care staff to utilize if more longitudinal studies are conducted.

Considerations and further research recommendations

Although there were differences in all-occurrence behaviors of interest among the subjects, my data are inadequate for determining social rank. Additionally, I was unable to continue data collection into adulthood to determine adult social rank. After this study was completed, three male subjects were relocated to another zoo. I recommended which individuals to relocate based on results from this study. I recommended F-Flat as a potential alpha, Spot as a middle rank, and Seuss as a low rank. The individuals that have been relocated for prospective new packs have not been introduced to opposite sex individuals; therefore, I am unable to determine if the individual(s) that displayed the more dominant or curious behaviors are actually going to be the alpha in a new pack.

After the birth of this study litter, OKC Zoo received a recommendation from the APD SSP to spay the adult female. Thus, OKC Zoo will not have another litter unless a new breeding pair is recommended. Therefore, I was unable to replicate this study at the OKC Zoo. After the relocation of the three male subjects from the OKC pack, I briefly evaluated social dynamics of the remaining pack members to see if individuals were still displaying the same behavior types. I did not collect data on these observations. However, after only two brief observation sessions and discussions with OKC Zoo staff, I observed a difference in the types of behaviors these individuals were displaying. For example, Wishbone, who was often more submissive and less curious about the novel objects during the study, was displaying fewer submissive behaviors and was characterized as dominant by the OKC Zoo staff based on observations of his interactions during feeding and enrichment. Due to this shift in dynamics of the remaining pack, I

hypothesize that social dynamics may be influenced by pack composition and may change when individuals are added or removed from the pack.

After evaluating the results of the focal observations and novel object presentations, the method that zoo care staff could most easily utilize would be novel object presentations. If the bolder/more curious individuals do become the alphas of new packs, it would be feasible for zoo care staff to present novel objects to evaluate social behaviors in litters of APD puppies. The focal observations I performed, which included no additional items or objects, were not an ideal way to evaluate social dynamics. Due to the primarily inactive behaviors during my focal observations, few active social interactions occurred. I recommend that focal observations should occur when additional objects are given to the pack, such as enrichment, food, etc. If additional items are given, that may allow for more activity and more social interactions. Observations of APDs also should include interaction types, such as play, agonistic, or cooperative, as well as a record of which individuals were initiators and recipients. Interaction types should include not only socially active behaviors, but also passive behaviors such as social distance arrangements during resting. Reporting the closest neighbor would give insight to the possible bonds between pack members. Observations of resting arrangements should also take into account the number of individuals resting together, as well as the distance between them. Unfortunately, I was focused on the individual's behaviors during focal observations and did not realize the importance of the recipient in these interactions.

Further research into behavioral displays that express rank should include postures, vocalizations, and interactions. Postures and interactions were considered for use in this study. However, one of the goals of this research was to determine a method that zoo care staff could utilize to easily assess individual rank. Reliably measuring posture and interactions would be

time consuming and not easily implemented by most animal care staff. In future studies on APDs, these types of behaviors could be used to evaluate differences in behavior among littermates as well as the evaluation of pack dynamics.

An individual's posture during interactions, has been shown to express rank in observational studies of other canids (van Hooff and Wensing, 1987; Bauer and Smuts, 2007; van der Borg et al., 2015). In three previous studies on wolves and domestic dogs, postural differences in dyadic interactions were used to determine dominant versus subordinate individuals. Higher postures such as tail and head held high, were signs used to signal a dominant status, whereas lower postures were signals of submission or subordination (van Hooff and Wensing, 1987; Bauer and Smuts, 2007; van der Borg et al., 2015). Tighe (2013) went even further and classified APD postures into dominant, submissive, defensive, and aggressive using subtle differences in how APDs hold their tails and ears during specific social interactions.

In addition to postures, vocalizations could be insightful for behavioral observations. Vocalizations of African painted dogs include various types of sounds that are given in times of cooperation, submission, appeasement, or distress (Robbins, 2000). Vocalizations by painted dogs are often very brief or hard to attribute to an individual during group interactions. Although vocalizations are hard to differentiate, in future studies I recommend that vocalization occurrences should be taken into consideration during behavioral observations. The type of vocalization in addition to the type of interaction may be useful in evaluation of social interactions, even if it is hard to determine who made the sound.

I performed this study to provide insight specifically on captive populations of APD. While these types of studies could be applied to wild populations, this study was very specific to improving captive management by informing decisions about which individuals to select to form

a new pack. Any social conclusions gathered from captive studies should be used cautiously if applied it to wild populations (de Villiers et al., 2003; McPhee, 2004).

Conclusions

My study was a preliminary evaluation of the establishment of pack behaviors in pups. I was unable to replicate this study on another pack or monitor the subjects into adulthood. I recommend that further evaluation of the behavioral differences in littermates should be continually observed as pack dynamics change. Additionally, it is important to continue data collection after animals are transferred to other institutions to form new packs. I cannot conclude if certain observed behaviors designated rank within my study pack. I can conclude that my study pack was commonly inactive, focal observations in which enrichment or food was not provided were not ideal for observing social interactions, and hanging novel objects resulted in a varying response from the pups.

Social distance was ideal to observe in these types of focal observations, but unfortunately, I did not record the nearest neighbor when recording social distance. Documentation of interactions between individuals, active or passive (resting arrangements), would be ideal in further analysis of ways to evaluate rank and social bonds in African painted dogs. Although no new individuals have been introduced to any of the OKC Zoo study pack, management can take into consideration the implications of this research when artificial packs are formed. Management teams also could explore novel object presentation methods to evaluate new litters of captive APD. For zoos to maintain a self-sustaining APD population it is essential to continue to increase understanding of the social structure and social development of captive-housed African painted dogs. My study provides some initial guidelines for the identification of pack status and development in pups.

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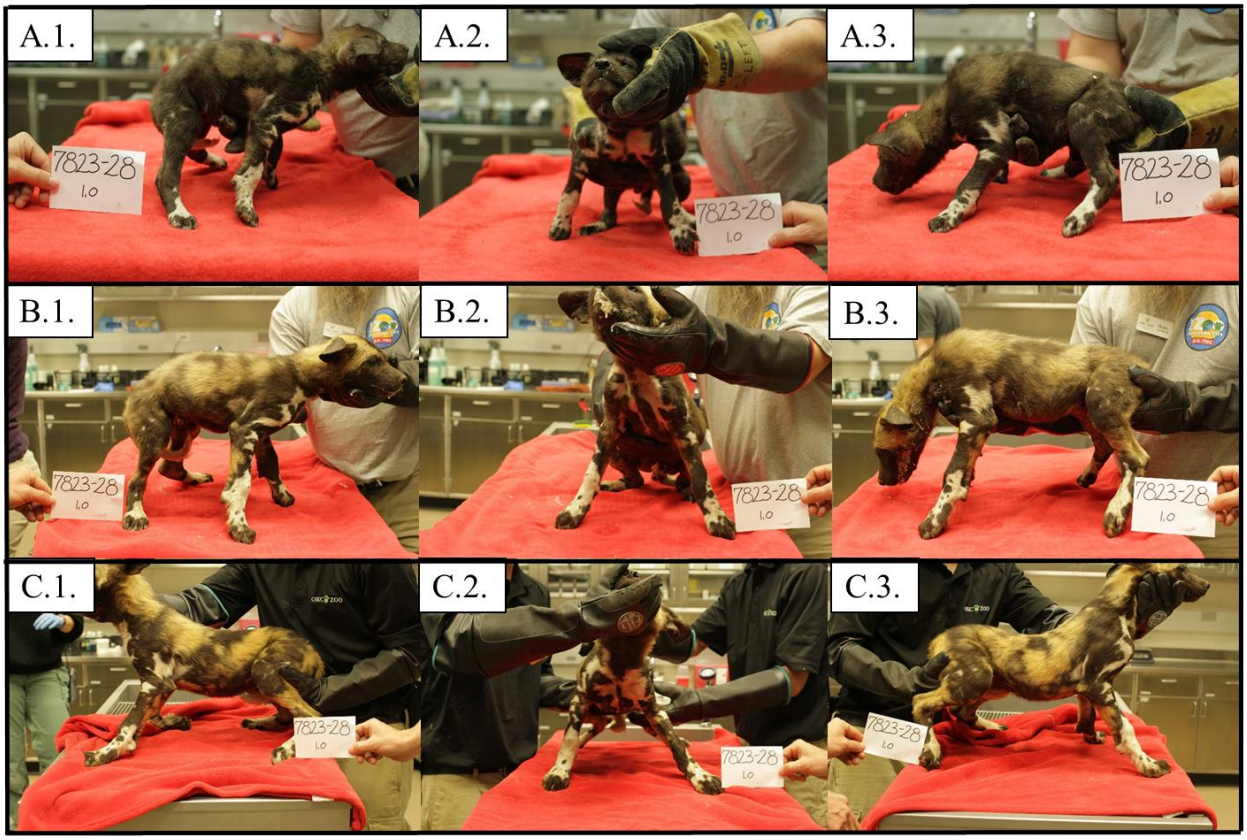
Appendices

Appendix 1. Aerial view of the Oklahoma City Zoo African painted dog exhibit via Google Earth. The red star was the focal observation viewing area, the blue star was the novel object presentation viewing area, and the yellow star was the viewing area for the female pups after they were separated.

Appendix 2. Examples of identification pictures taken on three occasions at each vaccination exam, six weeks old (A), eleven weeks old (B), and fifteen weeks old (C). Pictures were taken from each angle, left profile (1), front (2), and right profile (3), to have a record of the development of distinguishing markings for each individual.



Appendix 3. Sample focal observation data sheet including the defined instantaneous and all-occurrence behaviors from the ethogram.

African Painted Dog Focal Data Sheet

Date _____ Pup's Age in Days _____

Time _____ Pup's Name _____

Temp _____

Instantaneous Data

Min	Behavior									Social Distance					
	IN	SA	FF	PL	IA	OAG	OAF	SOL	NV	C	P	O	D	NV	Closest:
1															
2															
3															
4															
5															
Total	IN	SA	FF	PL	IA	OAG	OAF	SOL	NV	C	P	O	D	NV	

All-Occurrence Data

Behavior	**No. of Occurrences**	**Total**
Bite		
Stalking		
Scent Marking		
Rolling on back to belly		
Flee		
Chase		
Begging		
Leading		
Following		

Notes:

Appendix 4. Approved objects used in novel object presentations. Not all items were used in the data calculations. Hanging items were hung on a zip line; the chain was covered in PVC pipes.

Object description	**Presentation type**
Empty Cardboard Boxes	Placed
Large plastic solid blue rectangle	Placed
"Boomer Balls" (solid plastic balls)	Thrown
Blood popsicle	Placed
Paper bags – hay inside	Placed
Perfume on large solid plastic egg	Thrown
Molasses on hollow plastic spools	Thrown
Mice and chicks	Thrown
Ungulate feces	Placed
PVC Puzzle feeder (PVC pipes that can come apart)	Thrown
Italian spices in paper towels	Thrown
Large plastic white "Iceberg" in water pool	Placed
Mulberry tree limbs	Thrown
Hanging plastic ball with fire hose on top	Placed
Rabbits	Thrown
Cow bones	Placed
Horse carcass feed	Placed
Bison hair	Placed
Piles of popcorn	Placed
Hard-boiled ostrich egg	Thrown
Hanging cardboard (horizontal square of cardboard)	Placed
Hanging boomer ball	Placed
Hanging deer carcass	Placed
Hanging blood popsicle	Placed
Hanging zipline toy (cardboard box on the top, then boomer ball, then fire hose hanging)	Placed
Hanging pecca ball with grape vines stuffed inside	Placed
Cardboard with paint on it	Placed
Piles of ice cubes	Placed
Hanging boomer ball with kibble and blood	Placed
Hanging platform	Placed
Hanging shrimp popsicle	Placed
Mirror	Placed outside of fencing