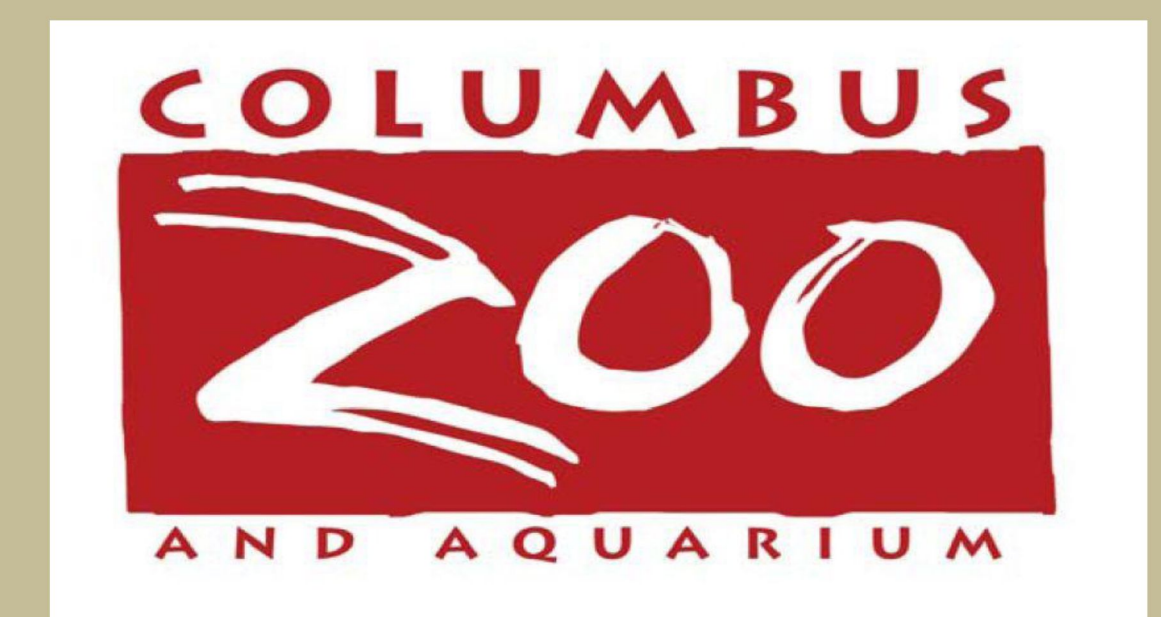


Captive female bonobos (*Pan paniscus*) tend to be more social during tool use than males

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Introduction:

Tool use occurs in several non-human species, including primates. Within the genus *Pan*, chimpanzees (*P. troglodytes*) exhibit tool use in both the wild and captivity, while tool use in bonobos (*P. paniscus*) has been documented in captivity and suggested to occur in the wild (White et al. 2008). Four conditions have been proposed to facilitate the evolution of material culture: 1) ecological opportunity, 2) motor dexterity, 3) cognition for problem solving and 4) social tolerance to allow for social learning of tool use behavior (van Schaik et al. 1999). Social tolerance behavior varies among the great apes and a recent captive study showed that bonobos had fewer neighbors present during tool use acquisition than what has been reported for chimpanzees and gorillas (Boose et al 2013, Lonsdorf et al. 2009). These captive bonobos also exhibited a female bias in tool use acquisition that has been well documented in *Pan* (Boose et al. 2013, see also Gruber et al. 2010). We sought to investigate patterns of affiliation and association during tool use within this captive group of bonobos by analyzing sex and age differences. Based on what has been reported for bonobos regarding their affiliative patterns, we predicted females would be more social than males.

Methods:

Data were collected between June and August 2011 on 16 bonobos housed at the Columbus Zoo and Aquarium, Columbus, OH. At the time, the population included 8 males and 7 females of various age classes. Individuals were videotaped and recorded using all-occurrence sampling for tool use. Videos were analyzed and coded later where party size within a 4 meter radius of the mound was determined for each fishing bout. We used ANOVA and a priori orthogonal planned comparisons (Sokal and Rohlf 2012) to test for differences in party size between 1) males and females, 2) adult females and adolescent females, and 3) adult males and adolescent males. Individuals who fished infrequently (5 bouts total or less) as well as dependent offspring were excluded from our analyses.

Results:

Party size during tool use was not equally distributed across the population (Figure 1). The individuals who fished too infrequently to be included (n=4) were all wild-born. Females fished in larger groups (avg.=2.8 individuals) than males (avg.=2.3 individuals) (n=9, F=4.38, p<0.05) (See Figure 2). While there was no difference between adult and subadult males, adult females fished in significantly larger groups than subadult females (n=5, F=26.03, p < 0.0001) (See Figure 2).



Adult male, Maiko, fishing.

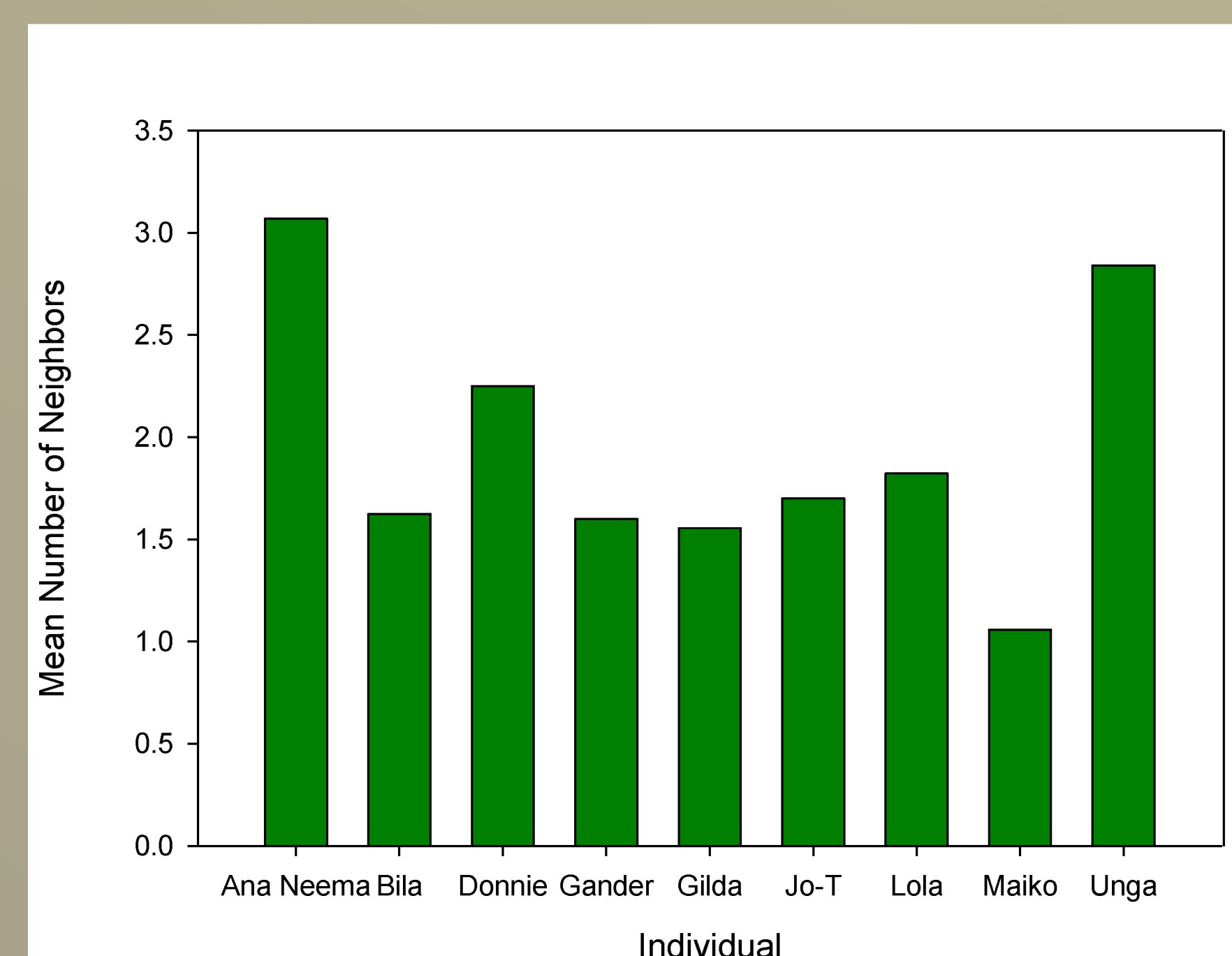


Figure 1. Mean Number of Neighbors During Tool Use by Individual

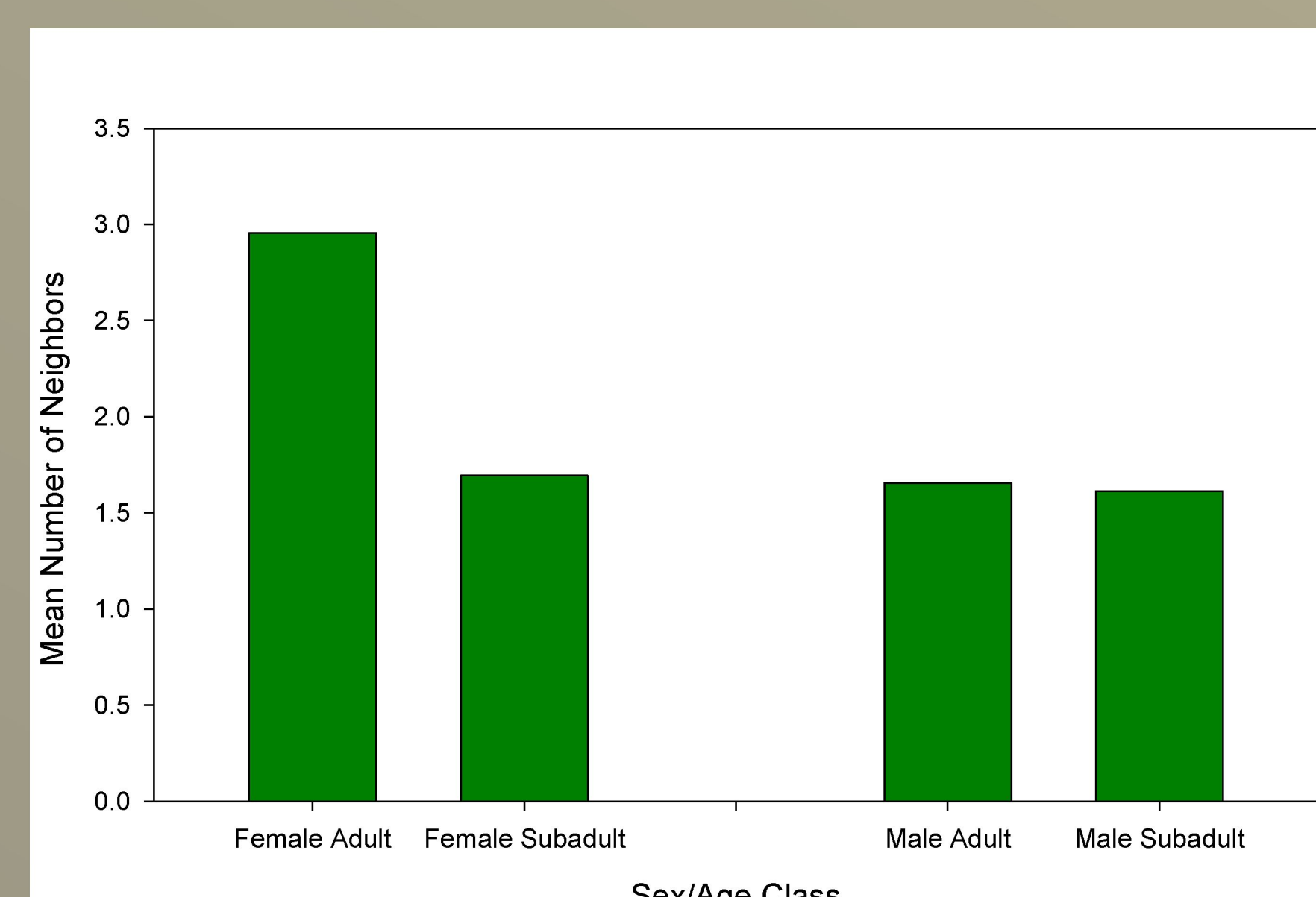


Figure 2. Mean Number of Neighbors During Tool Use by Age/Sex Class

Discussion:

Research on wild bonobos has revealed strong relationships between adult females, a stark contrast to the male-male social affiliation seen in chimpanzees. However, studies of captive bonobos have illustrated that male-female and male-male associations are just as frequent as female-female dyads (Stevens et al. 2006). Specifically, females may not always groom more frequently or occur in close proximity more than other sex combinations. This study demonstrates that female-female affiliation in captive bonobos may be evidenced in other behavioral contexts. These results also support previous knowledge of bonobo sociality. White (1988) reported that in wild bonobos, males tend to be more solitary than females, often traveling alone between food patches. Our results indicate that solitary behavior in males may extend into food acquisition behavior such as termite fishing.

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References:

- Boose K, White F, Meinelt A. 2013. Sex differences in tool use acquisition in bonobos (*Pan paniscus*). *American Journal of Primatology* 75:917–926.
- Gruber T, Clay Z, Zuberbühler K. 2010. A comparison of bonobo and chimpanzee tool use: evidence for a female bias in the *Pan* lineage. *Animal Behavior* 80:1023–1033.
- Lonsdorf E, Ross S, Linick S, Milstein M, Melber T. 2009. An experimental, comparative investigation of tool use in chimpanzees and gorillas. *Animal Behaviour* 77:1119–1126.
- Sokal RR, Rohlf FJ. 2012. *Biometry: the principles and practice of statistics in biological research*. New York: W. H. Freeman and Co. p 937.
- Stevens JMG, Vervaecke H, De Vries H, Van Elsacker L. 2006. Social structures in *Pan paniscus*: testing the female-bonding hypothesis. *Primates* 47:210-217.
- van Schaik CP, Deaner RO, Merrill MY. 1999. The conditions for tool use in primates: implications for the evolution of material culture. *Journal of Human Evolution* 36:719–741.
- White FJ. 1988. Party composition and dynamics in *Pan paniscus*. *International Journal of Primatology*. 9:179-193.
- White FJ, Waller MT, Cobden AK, Malone NM. 2008. Lomako bonobo population dynamics, habitat productivity, and the question of tool use. *American Journal of Physical Anthropology* 46:222.