

# Kin Preference in Bonobos (*Pan paniscus*)

By: Stefan Self



# Background

Background---Hypothesis---Procedure---Data---Results—Future Directions--Works Cited

- Bonobos are a social species of ape native to the Congo (Cawthon, 2010).
- Bonobos share a common ancestor with humans that lived ~ 7 mya.

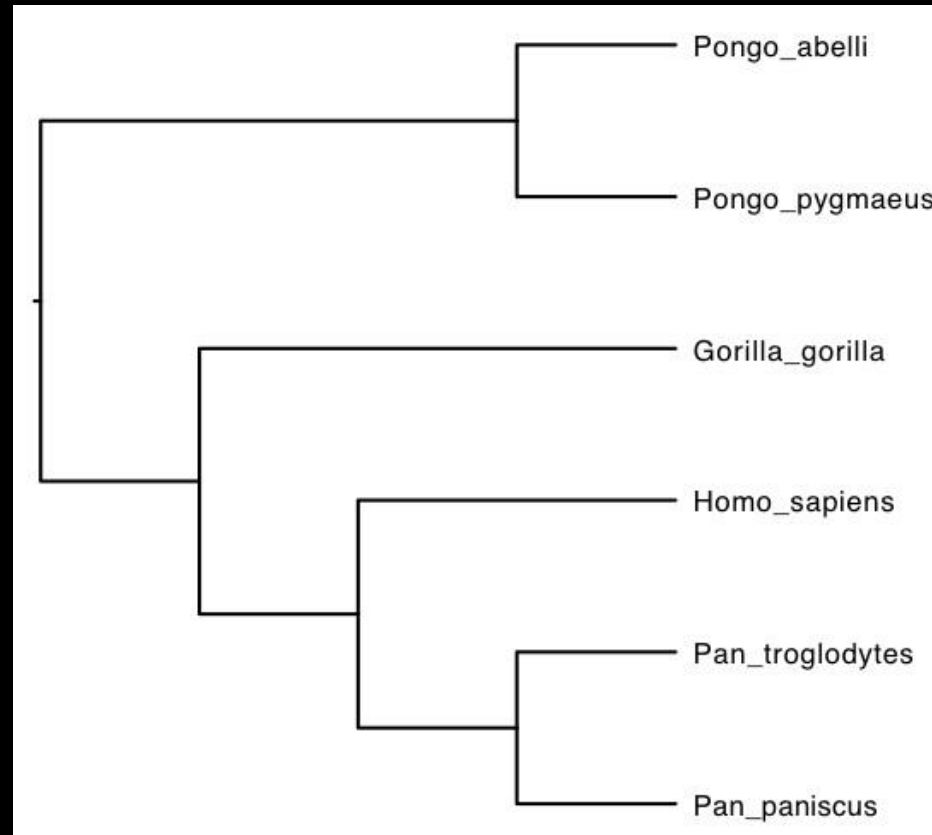
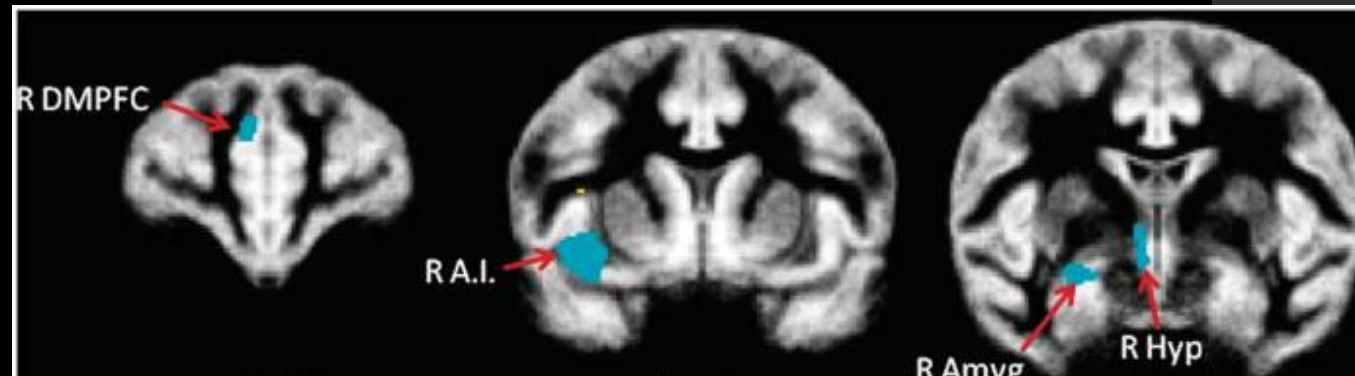


Figure 1: Phylogeny of ape species (<http://nothinginbiology.files.wordpress.com/2012/10/primates1.jpg>)

# Background

Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited

- Individuals protect and console kin more frequently than those with less relationship (Palagi, 2013).
- Compared to chimps, bonobos have more grey matter brain areas that function in empathy and emotion (Rilling, 2012).

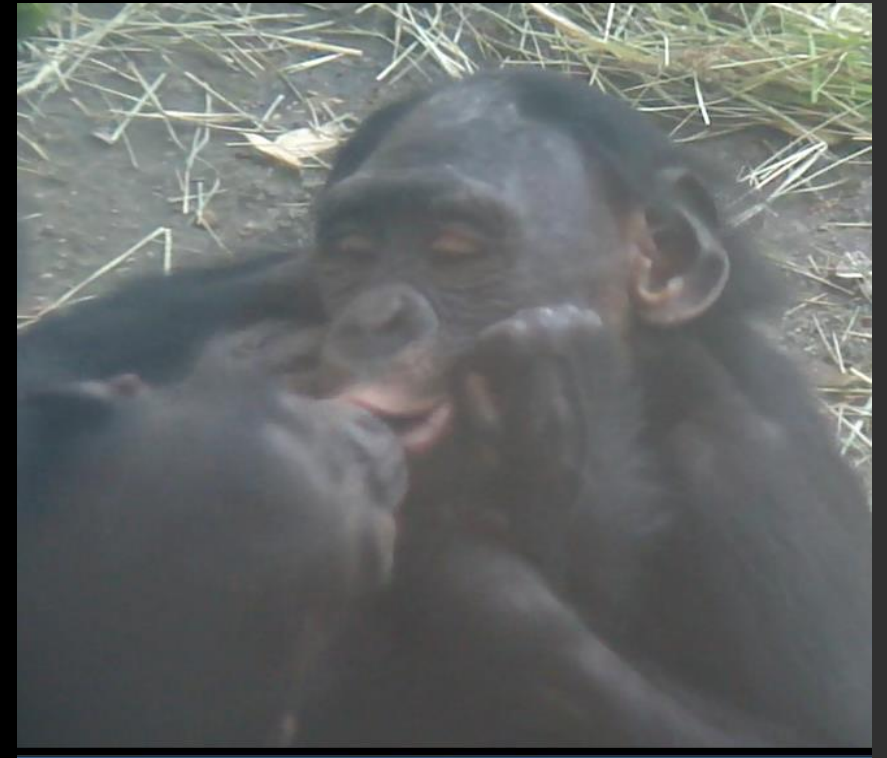


(Rilling, 2012) Figure 2: Comparison of chimp and bonobo brain regions

# Empathy

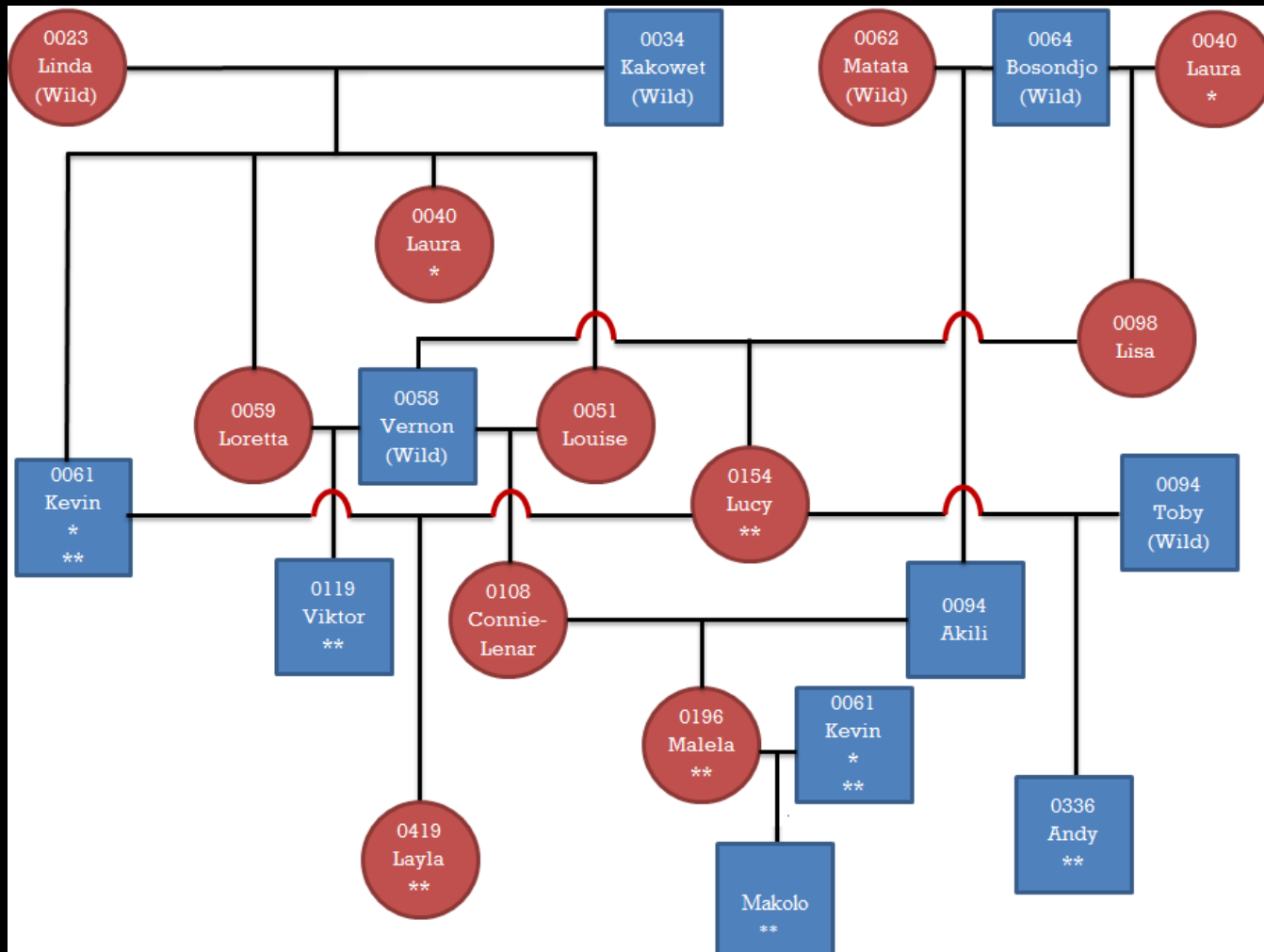
Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited

- Human friends have similar genotypes on the SNP level (Christakis, 2014).
- Like humans, bonobos show consolidative behaviors more frequently with kin.
- Anxiety levels of the victim decreases with consolation after a conflict (Demuru, 2012).



# Pedigree of Bonobos at FW Zoo

Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited



## Other members:

- Machumba- adult female; unrelated
- Johari- adult female; unrelated

Figure 3: Bonobo pedigree information provided by Fort Worth Zoo; image created by Adriana Lindsey

# Hypothesis

Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited

- Bonobos at the Fort Worth Zoo will interact more frequently with individuals of greater genetic similarity.



# Experimental Procedure

Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited

- Bonobos at the Fort Worth Zoo were recorded by a digital camera.
- Recorded interactions between individuals were noted within 30 second intervals.



# Observations

Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited

- Types of interactions that were noted:

Following

Sexual interaction

Play

Grooming

Aggressive behavior

Affiliation

- Observations were made in 1 hour intervals during weekdays, sometime between 11am and 4pm.



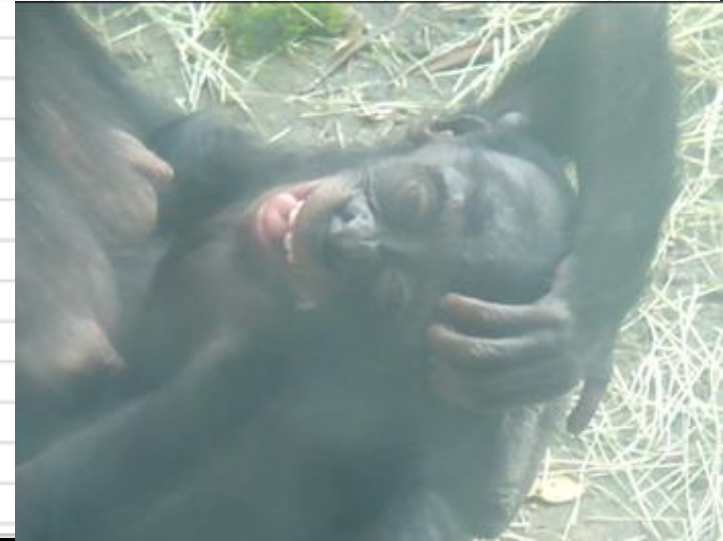


# Data Records

Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited

Table 1: Data records of interactions

	11/7/2014		3:30									1	2	3	4	5	6	7	8	9	
Time	Physical Contact	Groom	Follow	Carrying	Nurse	Sexual act	Play	Affiliator	Push/Pull	Protect	Embrace	Makolo	Layla	Lucy	Malela	Kevin	Andy	Victor	Johari	Machula	Inside
0.5							23					1	1	1	1	0	0	0	1	1	1
1							23					1	1	1	1	0	0	0	1	1	1
1.5							23					1	1	1	1	0	0	0	1	1	1
2							23					1	1	1	1	0	0	0	1	1	1
2.5							23					1	1	1	1	0	0	0	1	1	1
3							23					1	1	1	1	0	0	0	1	1	1
3.5			23				23					1	1	1	1	0	0	0	1	1	1
4												1	1	1	1	0	0	0	1	1	1
4.5							32					1	1	1	1	0	0	0	1	1	1
5											23	1	1	1	1	0	0	0	1	1	1
5.5			23									1	1	1	1	0	0	0	1	1	1
6							32					1	1	1							
6.5							32					1	1	1							
7	14											1	1	1							
7.5												1	1	1							
8												1	1	1							
8.5							21	41		41		1	1	1							
9								41		41		1	1	1							
9.5								41		41		1	1	1							
10	14											1	1	1							
10.5							21					1	1	1							
11												1	1	1							
11.5									23			1	1	1							
12				23, 41								1	1	1							





# Data

Background---Hypothesis---Procedure---Data---Results--Future Directions---Works Cited

## Genetic relationship

## Percent interaction

Table 2: Matrices of genetic relation and percent interaction

	Makolo	Layla	Lucy	Malela	Kevin	Andy	Victor	Johari
Makolo								
Layla	0.26563							
Lucy	0.0625	0.5						
Malela	0.5	0.03125	0.0625					
Kevin	0.5	0.5	0	0.0625				
Andy	0.03125	0.25	0.5	0.0625	0			
Victor	0.0625	0.125	0.25	0.125	0.125	0.125		
Johari	0	0	0	0	0	0	0	
Machula	0	0	0	0	0	0	0	0

	Makolo	Layla	Lucy	Malela	Kevin	Andy	Viktor	Johari
Makolo								
Layla	0.26984							
Lucy	0.00529	0.24299						
Malela	0.81667	0.10053	0.01587					
Kevin	0.10606	0	0	0				
Andy	0.02041	0	0	0	0			
Viktor	0.1087	0	0	0	0.29714	0.03175		
Johari	0.03409	0.01639	0.15574	0.07197	0	0.45918	0	
Machula	0	0	0	0	0	0	0	0.21094

$$0.5^n$$

(n = # of nodes between individuals on pedigree)

$$\frac{\# \text{ of intervals interacting}}{\# \text{ of intervals in the same room}}$$

# Results

Background---Hypothesis---Procedure---Data---Results---Future Directions---Works Cited



Permutation test  
( $q_{ap}=0.364$ ,  $p<0.05$ )

- Significant relationship between genetic similarity and frequency of interactions

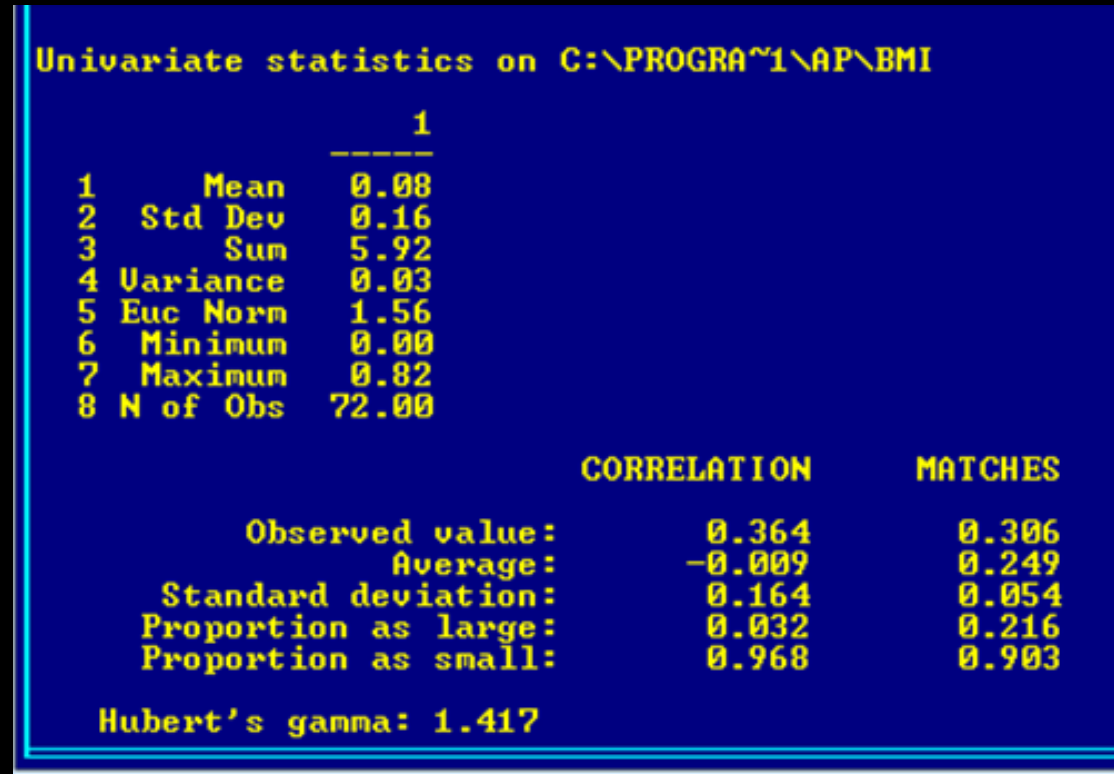


Figure 4: Permutation test of matrices in Anthropac

# Results

Background---Hypothesis---Procedure---Data---Results---Future Directions---Works Cited

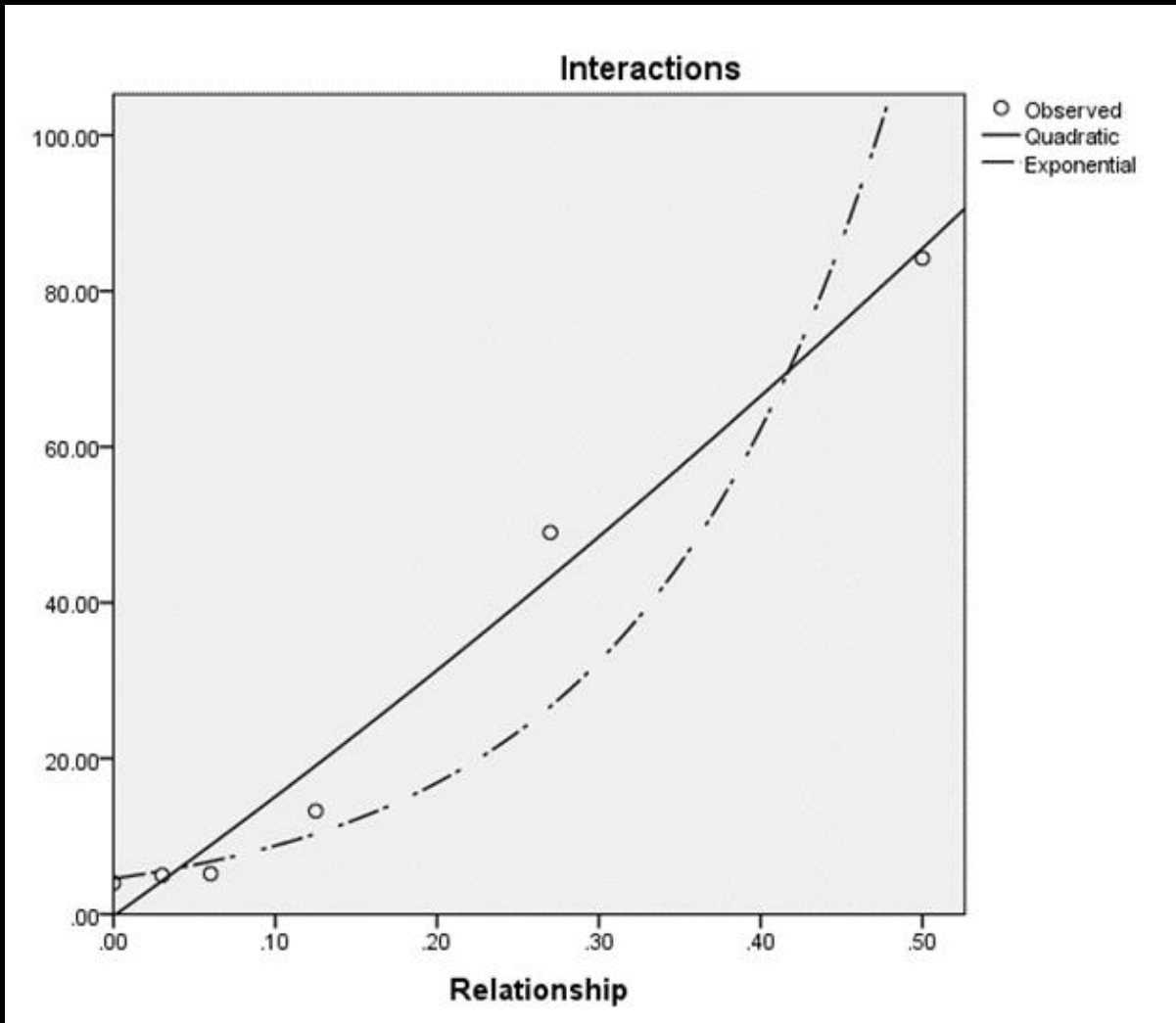


Figure 5: Quadratic and exponential regression of interactions and degree of kinship SPSS

- Combined and averaged interactions of individuals of the same degree of kinship
- Quadratic regression; significance of 0.003
- Exponential regression; significance of 0.002
- As genetic relationship increases, number of interactions increases.

# Future Directions

Background---Hypothesis---Procedure---Data--Results--Future Directions---Works Cited

Determine:

- what types of interactions provoke or influence other types of interactions.
- if young males develop different social patterns than young females.
- which interactions are more frequent between various levels of kinship.



# Future Directions

Background---Hypothesis---Procedure---Data--Results--Future Directions---Works Cited

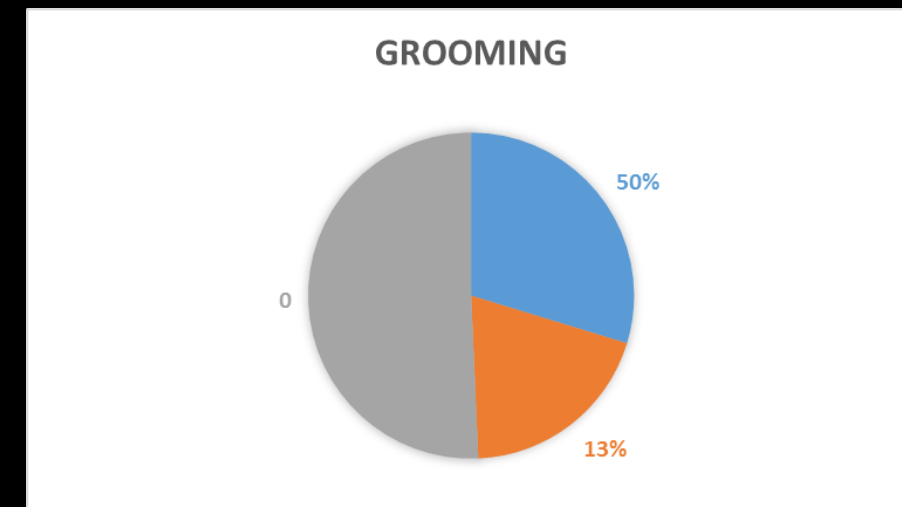
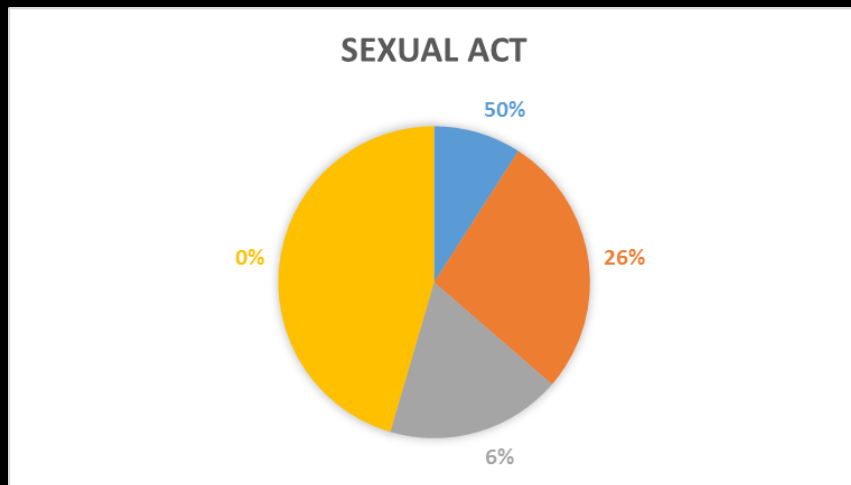
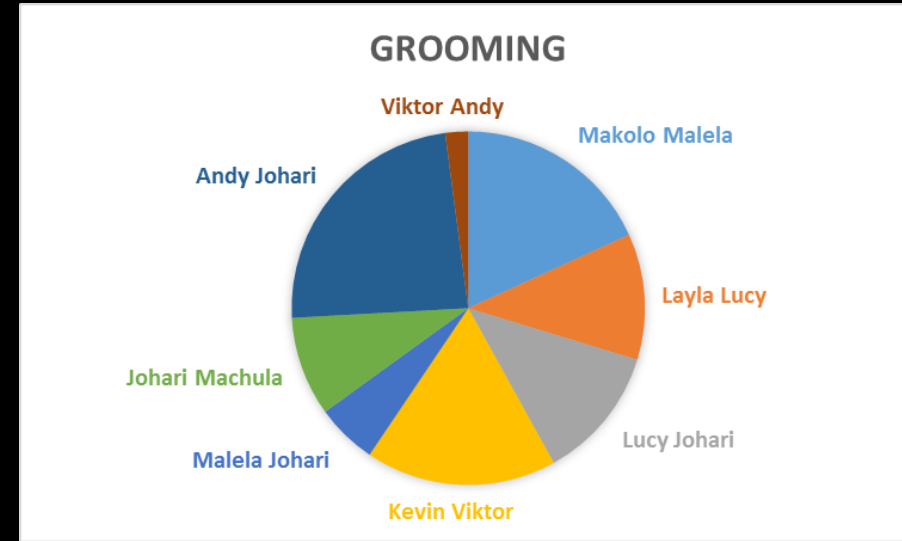
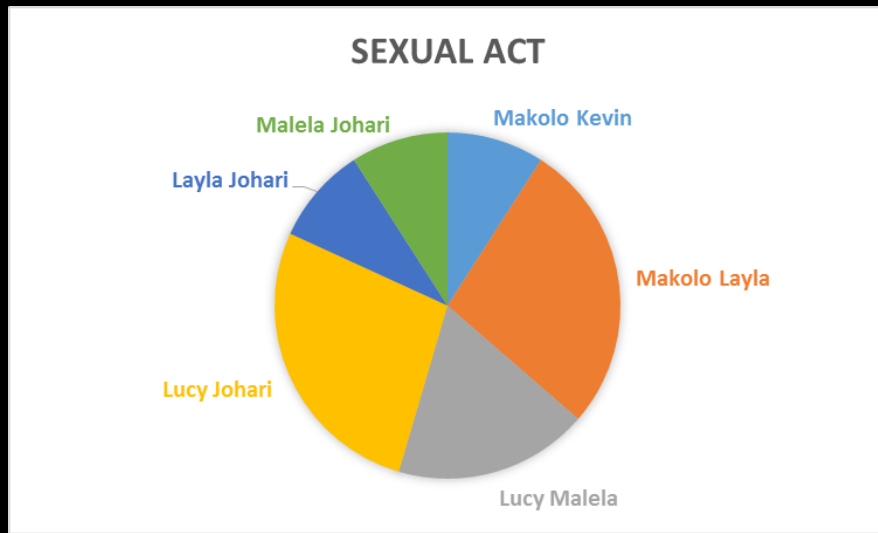


Figure 6: Relative amounts of interactions above, relative amounts of interaction within various degrees of genetic relation

# Works Cited

Background---Hypothesis---Procedure---Data---Results---Future Directions---Works Cited

- Cawthon Lang KA. 2010. Primate Factsheets: Bonobo (*Pan paniscus*) Behavior.
- Christakis NA and Fowler JH. 2014. Friendship and natural selection. *Proceedings of the National Academy of Sciences of the United States of America (PNAS)* 111:10796-801.
- Demuru E and Palagi E. 2012. In bonobos yawn contagion is higher among kin and friends. *PLoS One* 7(11):e49613.
- McElroy, B., Clark, Dr. M. 2013. Alloparenting Behaviors in Bonobos (*Pan paniscus*) Department of Biology, Texas Wesleyan University.
- Palagi E and Norscia I. 2013. Bonobos protect and console friends and kin. *Plos One* 8(11):1-11.
- Rilling JK, Scholz J, Preuss TM, Glasser MF, Errangi BK, Behrens TE. 2012. Differences between chimpanzees and bonobos in neural systems supporting social cognition. *Social Cognitive and Affective Neuroscience* 7(4):369-79.



*Special Thanks to Dr. Clark and Dr. Benz*