

Social relationships from an evolutionary and comparative perspective: The role of personality, sex, age, and social position in dyadic social relationships in nonhuman primates

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ABSTRACT

Individuals build and maintain relationships in many species. To better understand universal mechanisms and processes of social relationships, in particular of their phylogenetically older nonverbal components, comparative studies of our closest living relatives – the nonhuman primates – are particularly illuminating. Over three years, we studied personality differences and social relationships in Crab-eating macaques that we analysed using variable-oriented and individual-/ dyad-oriented approaches.

METHODS

Individual-specific patterns of behaviour (Personality)

Methodological approach

- Generation of 18 species-specific personality constructs for captive macaques using the Behavioural repertoire x Environmental Situations Approach (Uher, 2008a,b)

Measurement instruments: Macaque Personality Inventory (MPI)

- 18 trait-adjective items (TA)
- 30 behaviour-descriptive Verb items (BV) (Uher et al., in prep.; cf. Uher, 2011; Uher & Asendorpf, 2008 for ape studies)

Interrater reliability (item-level)

- ICC(3,k) = .74 (mean reliability of all 6 study periods)

Test-retest reliability (item-level) over 3–6 weeks

- $r_t = .74$, range .42–.82 for 44 items (mean reliability of all 3 years)

Personality factors and their 1- and 2-year stabilities

- Exploratory factor analyses (principle axis factoring, promax rotation) on all 44 reliable items, parallel analyses
- Separate and joint analyses of both instruments yielded 4 robust factors
- Variance explained - single factors: 27%, 25%, 10%, 8%; cumulative: 70%

Personality factor	1-year stability		2-year stability	
	year1->year2	year2->year3	year1->year3	
Playful-active-curious	.93	.68	.73	
Aggressive-competitive	.75	.59	.56	
Prosocial-gregarious	.59	.66	.41	
Assertive-nonassertive	.65	.52	.40	

Table 1: Pearson correlations of factor scores across years

- All coefficients are significant ($p < .05$)

CROSS-SECTIONAL RESULTS

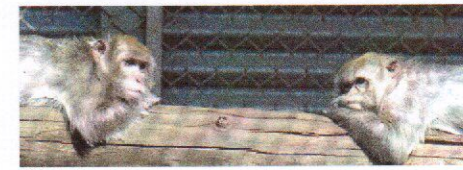
Variable-oriented: Absolute factor score differences

- The degree of similarity depends on the personality domain studied

Personality factor	Dyads upper quartile		Dyads below median		Effect size Cohen's d
	M	SD	M	SD	
Aggressiveness index*					
Playful-active-curious	1.00	1.05	0.95	-0.11	0.17
Aggressive-competitive	1.15	1.07	0.99	-0.23	0.04
Prosocial-gregarious	1.09	1.13	0.95	0.20	0.13
Assertive-nonassertive	0.96	0.99	0.95	-0.25	0.27
Prosociality index					
Playful-active-curious	0.95	1.09	0.18	0.15	0.22
Aggressive-competitive	1.06	1.12	0.95	-0.11	0.16
Prosocial-gregarious	1.01	1.20	0.23	0.17	0.30
Assertive-nonassertive	0.65	1.04	0.25	0.13	0.32
Relationship index					
Playful-active-curious	0.97	1.12	0.19	-0.22	0.30
Aggressive-competitive	1.12	1.11	0.99	-0.14	0.16
Prosocial-gregarious	1.01	1.22	0.27	0.10	0.44
Assertive-nonassertive	0.91	1.07	0.22	0.20	0.55

Table 4: Mean factor score similarity over three years contrasted between dyads scoring in the upper quartile versus below median in three relationship measures. * For aggressiveness the upper decile was used due to infrequent occurrence of aggressive behaviours.

- Higher effect sizes indicate lower factor score differences, i.e. higher similarity in the upper quartile (decile) dyads.
- Mean effect sizes d computed using Fisher r -to- Z transformation



Dyad-specific patterns of behaviour (Social relationships)

Ethological observations of dyadic interactions

- focal animal sampling, 85 min per individual in each of 6 study periods

Test-retest reliability of dyadic relationship measures over 4 weeks

Dyadic relationship measure	t ₁ -t ₂ (year 1)	t ₂ -t ₃ (year 2)	t ₁ -t ₃ (year 3)
Aggressiveness index	.02 (.541)	.17 (.000)	.17 (.000)
Prosociality index	.33 (.000)	.31 (.000)	.27 (.000)
Proximity	.75 (.000)	.55 (.000)	.67 (.000)
Grooming	.51 (.000)	.33 (.000)	.58 (.000)
Social Play	.68 (.000)	.81 (.000)	.90 (.001)
Relationship index	.73 (.000)	.62 (.000)	.67 (.000)

Table 2: Pearson correlations of dyadic interaction scores

- Indices = means of z -standardized scores of various behavior measures
- Reliability based on $N = 1405$ - 1457 dyads in years 1 and 2; $N = 1307$ - 1331 dyads in year 3; $r > .50$ in boldface; two-sided p values in parentheses

Stability of dyadic relationships over 1 and 2 years

- Correlations of mean-scores per year

Dyadic Relationship	1-year stability		2-year stability	
	year1->year2	year2->year3	year1->year3	
Aggressiveness index	.14 (.000)	.17 (.000)	.16 (.000)	
Prosociality index	.42 (.000)	.36 (.000)	.30 (.000)	
Proximity	.46 (.000)	.50 (.000)	.48 (.000)	
Grooming	.42 (.000)	.24 (.000)	.33 (.000)	
Social Play	.83 (.000)	.00 (.520)	.02 (.607)	
Relationship index	.49 (.000)	.51 (.000)	.49 (.000)	

Table 3: Pearson correlations of relationship measures across years

- Stability analyses based on $N = 1405$ - 1457 dyads in year1-year2, and $N = 755$ dyads in year1-year 3 and year 2-year3.
- Significant correlations in boldface; two-sided p values in parentheses

Dyad-oriented: Profile correlations

- Profile correlations provide an index of similarity for each dyad

Relationship measure	Dyads upper quartile			Dyads below median			Differences of means		Effect size d
	M	(SD)	N	M	(SD)	N	t	p	
Aggressiveness index*									
Year 1	-.08	(.89)	131	.07	(.90)	1121	-1.80	.077	-.17
Year 2	-.08	(1.00)	130	-.00	(.93)	1024	0.90	.366	.08
Year 3	.02	(.87)	123	-.00	(.93)	881	0.27	.787	.03
Prosociality index									
Year 1	.29	(.94)	351	-.03	(.88)	961	5.70	.000	.36
Year 2	.19	(.97)	342	-.06	(.92)	898	4.16	.000	.27
Year 3	.22	(.96)	325	-.08	(.90)	877	4.94	.000	.34
Relationship index									
Year 1	.21	(.94)	352	-.07	(.87)	720	4.91	.000	.32
Year 2	.19	(.92)	337	-.08	(.93)	675	3.98	.000	.27
Year 3	.28	(.94)	321	-.11	(.90)	626	6.22	.000	.45

Table 5: Profile similarity contrasted between dyads scoring in the upper quartile versus below median in three different relationship measures. * For aggressiveness the upper decile was used due to infrequent occurrence of aggressive behaviours.

- Higher effect sizes indicate higher profile correlations, i.e. higher similarity in the upper quartile (decile) dyads as compared to those below median.
- Statistical analyses performed on Fisher r -to- Z transformed profile similarity correlations. Reported scores were transformed back to regular correlations.

Aggressiveness characterises individuals, but not relationships

- Aggressiveness is a stable individual-specific pattern of behaviour in Java monkeys (constitutional to the personality factor Aggressive-competitive)
- However,
 - Individual aggressiveness is not associated with dyadic relationships
 - Aggressive interactions do not characterise dyadic relationships

Complementarity versus similarity hypotheses

- Results suggests that individuals in socially close dyads are more similar to one another in terms of their personality than individuals that avoid each other

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STUDIED INDIVIDUALS

- 104 Crab-eating macaques (Java monkeys; *Macaca fascicularis*, a species endemic to Southeast Asia) housed in three social groups (24–42 members) at the Ethology Station of Utrecht University, NL
- 69 females, 35 males
- 1 to 33 years ($Mdn = 6.4$; $M = 8.3$; $SD = 6.6$)
- 6 study periods (t_1 – t_6) in 3 consecutive years

ASSOCIATIONS with demographic variables

Age and social position

- Dyads of individuals of similar age are also more similar in the personality factor playful-active-curious, yet in no other factor
- Dyads of older individuals are slightly less similar to one another in the factors prosocial-gregarious and assertive-nonassertive
- Similarly, dyads of higher-ranking individuals are less similar to one another in their scores on the factor aggressive-competitive indicating some patterns of complementarity

Factor score differences	Absolute age difference	Mean age of dyad	Absolute rank difference	Mean rank of dyad
Playful-active-curious	.35	.04	-.02	.00
Aggressive-competitive	.06	.16	.41	.19
Prosocial-gregarious	.01	.13	.18	.02
Assertive-nonassertive	.01	.14	.36	.06
Profile correlations	-.16	.06	-.16	-.02

Table 6: Average correlations of scores of all dyads computed using r -to- Z transformation.



Same-sex and opposite-sex dyads

- Male and female same-sex dyads seem to show different patterns of similarity and dissimilarity

Factor score difference	Same sex dyads male	Same sex dyads female	Opposite sex dyads
Playful-active-curious	1.14 >***	0.79	0.85 <***
Aggressive-competitive	1.30	1.17	1.19
Prosocial-gregarious	0.72 <***	1.21	1.14
Assertive-nonassertive	1.00	0.96	1.03
	$N = 32$	176	205

Table 7: Mean factor score similarity for dyads scoring in the upper quartile of the relationship index contrasted between male versus female, and same-sex versus opposite-sex dyads.

CONCLUSIONS

- In socially housed Java monkeys, getting along well with other group members was generally more strongly associated with similarity rather than with complementarity in the individuals' personality.
- However, more fine-grained analyses of the roles of sex, age, and social position may also reveal some patterns of complementarity.
- Aggressiveness was constituent to a stable personality factor that, however, showed no associations with social relationships. Interestingly, Aggressiveness did not characterise dyadic relationships.

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