

Table 3 Varimax rotated solution of factor analysis. Factor loadings >0.30, <−0.30 and communalities (h^2) are reported. [x] shows the additional loadings following an oblique rotation

Behaviour	Sociability	Positive affect	Equitability	Anxiety	Activity	h^2
Grooming initiated	0.887					0.869
Grooming received	0.802					0.664
No. neighbours	0.811				[−0.54] ^a	0.841
Being approached	0.701				[−0.41] ^a	0.565
Approach others		0.597			−0.399	0.575
Play initiated		0.829				0.715
Play received		0.708				0.525
Point-affinitive behaviour		0.855				0.771
Grooming diversity			0.837			0.742
Groom density			0.825			0.751
Scratch				0.911		0.856
Autogroom				0.658		0.463
Activity			[−0.43] ^a		0.626	0.533
Aggression given					0.344	0.193
% variance explained	24.98	17.23	15.21	11.44	8.43	
Eigenvalue	3.5	2.41	2.13	1.60	1.18	

Analysis on correlation matrix, $N=75$

^a Indicates the additional variable loadings that exceeded ± 0.40 after oblique (direct Oblimin) rotation

correction; critical alpha set at $p=0.0167$). Sociability scores were significantly higher in CH than in BB and AR, whilst AR and BB did not differ from each other. Positive affect scores were also highest in CH, differing significantly from BB but not from AR. Post-hoc tests of equitability and activity scores were done with Gabriel's procedure following the unequal sample sizes and checked with Games–Howell procedure (Field 2005). Equitability scores were significantly higher in AR than in CH and BB, whilst CH and BB did not differ from each other. Activity scores were significantly lower in AR than in BB and CC, which did not differ from each other.

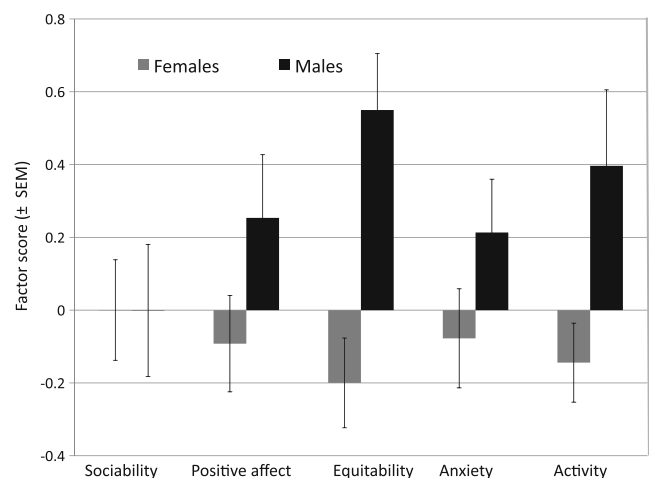
Discussion

This study aimed to identify personality traits in 75 captive chimpanzees from a broad base of ecologically relevant observable behaviours, with an emphasis on

social behaviour. All but one of the 16 behaviours were repeatable in at least two out of the three study populations, and most of them were repeatable in all three populations. Repeatability ranged between 0.21 and 0.93, which is within the values reported for most animal species (Bell et al. 2009). Thus, chimpanzees exhibited personality variation in several social behaviours. In addition, two commonly found personality traits, activity and aggressiveness, were confirmed to be repeatable in chimpanzees. The results support earlier, more limited behavioural personality studies on chimpanzees (Anestis

Table 4 Intercorrelations of the factors (Oblimin rotation)

Factor	1	2	3	4	5
1	1.0	0.129	−0.025	−0.072	−0.113
2		1.0	−0.038	−0.011	−0.105
3			1.0	0.143	−0.209
4				1.0	0.025
5					1.0

**Fig. 1** Factor scores of males and females (all zoos combined). Error bars indicate \pm SEM. Males differed significantly from females in all factors (from $p<0.001$ to $p=0.017$), except sociability ($p=0.541$)