Supplementary online material

Title: Male characteristics as predictors of genital color and display variation in vervet monkeys

Journal: Behavioral Ecology and Sociobiology

Mirjam M. I. Young[1,2,3], Sandra Winters[4], Christopher Young[3,5,6], Brigitte M. Weiß[1,2], Jolyon Troscianko[7], André Ganswindt[6,8,9], Louise Barrett[3,5], S. Peter Henzi[3,5], James P. Higham[4], Anja Widdig[1,2]

[1]Research Group Primate Behavioural Ecology, Department of Human Behavior, Ecology and Culture, Max-Planck-Institute for Evolutionary Anthropology, Deutscher Platz 6, 04103 Leipzig, Germany, [2]Behavioural Ecology, Institute of Biology, Faculty of Life Sciences, Leipzig University, Talstr. 33, 04103 Leipzig, Germany, [3]Applied Behavioural Ecology and Ecosystems Research Unit, University of South Africa, Christiaan de Wet Road & Pioneer Avenue, Florida, 1709, Gauteng, South Africa, [4]Department of Anthropology, New York University, 25 Waverly Place, New York, NY 10003, USA, [5]Department of Psychology, University of Lethbridge, 4401 University Drive, Lethbridge, Alberta, T1K 3M4, Canada, [6]Mammal Research Institute, Department of Zoology and Entomology, Faculty of Natural and Agricultural Science, University of Pretoria, Private Bag X20, Hatfield 0028, South Africa, [7]Science and Engineering Research Support Facility (SERSF), University of Exeter, Penryn Campus, Penryn, Cornwall, TR10 9FE, UK, [8]Endocrine Research Laboratory, Department of Anatomy and Physiology, Faculty of Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort 0110, South Africa, [9]Centre for Veterinary Wildlife Studies, Faculty of

Veterinary Science, University of Pretoria, Private Bag X04, Onderstepoort 0110, South Africa.

Address correspondence to Mirjam M. I. Young at the address above, or e-mail: mirjam_young@eva.mpg.de

Statistical analysis

Factor analysis

The factor analysis was checked for adequacy using the Kaiser-Meyer-Olkin measure (0.419) and Bartlett's test of sphericity (χ^2= 466.27, df= 21, p<0.001). All response variables included in the factor analysis and the model were checked for normality. LUM_R and CONTRAST_RW were log- and square root-transformed, respectively, before inclusion in the factor analysis to fulfill assumptions of normality.

Interaction terms in color models

In the full data set models we included the interaction male dominance * group mating activity as it is likely that males of varying dominance rank invest differently in color over the course of the mating season, and hence at different intensities of the group mating activity.

In the models using a subset of the data, we included the interaction between fGCM concentration * group mating activity as it is likely that genital color varies between males with differing fGCM concentrations depending on the intensities of the group mating

activity. The interaction between fGCM concentration * dominance was included as we expected male genital color to differ between males of higher dominance rank depending on their fGCM concentration compared to low ranking males. We included a 3-way interaction between these terms as genital color could be dependent on dominance rank, fGCM concentration and group mating activity, for example, due to individuals of different dominance ranks varying in their coping mechanism during high mating activity (Cheney and Seyfarth 2009; Gesquiere et al. 2011; see review Sapolsky 2005).

Random slopes in color models

By including random slopes, we aimed to keep the type I error at the nominal level of 5% (Schielzeth and Forstmeier 2009; Barr et al. 2013). As models without correlations between random intercepts and random slope terms did not perform worse than when these were included, we ran models without correlation parameters (Schielzeth and Forstmeier 2009; Barr et al. 2013) to reduce model complexity and increase model power.

For the set of models on the full data set, we included male dominance, tenure, injuries, group mating activity, and the interaction dominance * group mating activity as random slopes within male ID and male dominance, age, tenure, injuries, group mating activity, and the interaction dominance * group mating activity as random slopes within group ID.

In the set of models based on a subset of the data, we included male fGCM concentration, dominance, group mating activity, the interaction fGCM concentration * group mating activity, the interaction fGCM concentration * dominance, and the interaction fGCM concentration * dominance * group mating activity as random slopes within male ID and fGCM concentration, dominance, group mating activity, interaction fGCM concentration * group mating activity, the interaction fGCM concentration * dominance,

and the interaction fGCM concentration * dominance * group mating activity as random slopes within group ID.

Autocorrelation term

For the calculation of the autocorrelation terms we followed Kulik et al. (2015). In brief, we extracted the residuals from the previously described models and averaged the residuals of all data points separately for each recording day and weighed the residuals by the difference in the number of days to the specific recording day. The weights were normally distributed and had a mean of zero. Using an R function written by Roger Mundry, we maximized the likelihood of the model with the integrated autocorrelation term to define the standard deviation. We used the R function *optimize* from the package *stats* (version 3.2.3, R Core Team 2015) to get the best fitting standard deviation of the weighted function for the autocorrelation term by minimizing the Akaike's Information Criterion (AIC, Burnham and Anderson 2002). We included autocorrelation terms in models only when the estimate of the autocorrelation term was positive as a negative estimate is probably an artefact due to infrequent interactions. All calculated autocorrelation terms were z-transformed to a mean of zero and a standard deviation of one before inclusion in the models (Schielzeth 2010).

Results

RWB genital display context

We found a significant difference in the relative frequency of RWB genital displays across all contexts (Friedman rank sum test: χ^2= 60.692, df=5, p<0.001), with the display being shown on average in 4.1% of all dominance interactions, in 4.0% of all mating

interactions, in 2.2% of all grooming scans, in 1.4% of all inter-troop encounters, in 0.7% of all locomotion scans, and in 0.1% of foraging scans (see supplemental Fig. S2).

Reduced RWB genital display frequency

When repeating the RWB genital display model with the definition of the original described RWB displays (i.e. only including displays shown during male-male dominance context) and excluding all color variables and factors as predictors, the full model was highly significantly different from the null model (LRT: χ^2= 15.13, df=2, p<0.001). Notably, the effect of dominance rank remained highly similar to the model including displays shown during all other contexts (LRT: only male-male dominance context: estimate=1.425, SE=0.250, χ2= 11.567, df=1, p<0.001; with all contexts: estimate=0.475, SE=0.104, χ^2= 7.235, df=1, p=0.007), indicating that the effect of dominance rank was robust irrespective of the context in which the display was shown.

Supplemental tables

Table S1 Results of the factor analysis

	Factor1	Factor2	Factor3	Factor4
RED	0.047	-0.031	**-0.682**	0.075
BLUE	**0.873**	-0.203	-0.050	0.144
LUM_R[(a)]	0.180	0.152	**0.933**	0.263
LUM_W	0.079	**0.510**	0.065	0.280
LUM_B	0.040	**0.992**	0.094	0.038
CONTRAST_RW[(b)]	0.117	0.161	0.070	**0.975**
CONTRAST_RB	**0.857**	0.447	0.152	0.193
CONTRAST_WB	**0.666**	0.537	0.090	-0.184
Eigenvalue	1.997	1.823	1.387	1.197
Variance (%)	25.0	22.8	17.3	15.0

Factor loadings of the eight color predictors, as well as Eigenvalues and percent variance explained. Bold text marks largest loadings per predictor. [(a)] log-transformed, original mean±SD = 0.117±0.061; [(b)] square root transformed, original mean±SD = 0.053±0.023

Table S2 Overview of model terms and response and predictor transformations per model data set

model	**RWB genital display frequency (N=2 model)**		**inter-and intra-individual (N=14 models)**	**inter- and intra-individual (N=14 models)**
data set	**all context data set**	**reduced context data set**	**full data set**	**data subset**
RED	in FA_R	/	response	response
BLUE	in FA_B	/	response	response
LUM_R	in FA_R[(a)]	/	response (inter-individual[(a)])	response (inter-individual[(a)])
LUM_W	in FA_LUM	/	/	/
LUM_B	in FA_LUM	/	response	response (inter-individual[(a)])
CONTRAST_RW	test predictor[(b)]	/	response (inter-individual[(a)])	response (inter-individual[(a)])
CONTRAST_RB	in FA_B	/	response	response
CONTRAST_WB	in FA_B	/	response (inter-individual[(b)])	response[(b)]
FA_B	test predictor	/	/	/
FA_LUM	test predictor	/	/	/
FA_R	test predictor[(c)(d)]	/	/	/
tenure	test predictor[(a)(c)(d)]	test predictor[(a)(c)(d)]	test predictor[(a)(c)(d)]	/
age	/	/	test predictor[(d)]	/

injury	/	/	test predictor[(c)(d)]	/
dominance rank	test predictor[(c)(d)]	test predictor[(c)(d)]	test predictor[(c)(d)]	control predictor[(c)(d)]
group mating activity	control predictor[(b)(c)(d)]	control predictor[(b)(c)(d)]	control predictor[(b)(c)(d)]	control predictor[(b)(c)(d)]
dominance rank*group mating activity	/	/	test predictor[(b)(c)(d)]	control predictor[(b)]
mean fGCM	/	/	/	test predictor[(a)(c)(d)]
mean fGCM*dominance rank	/	/	/	test predictor[(a)(c)(d)]
mean fGCM*group mating activity	/	/	/	test predictor[(a)(b)(c)(d)]
mean fGCM*dominance rank*group mating activity	/	/	/	test predictor[(a)(b)(c)(d)]
male ID	random effect	random effect	random effect	random effect
group ID	random effect	random effect	random effect	random effect

[(a)] log-transformed; [(b)] square root-transformed; [(c)] random slope within male ID; [(d)] random slope within group ID; * between predictor terms indicating an included interaction;

Table S3 Variance and standard deviation (SD) of the random effects of the RWB genital display full model (GLMM with Poisson distribution)

random effect	**term**	**variance**	**SD**
maleID	intercept	0.0898	0.300
maleID	dominance rank	$4.22*10^{-6}$	$2.06*10^{-3}$
maleID	group mating activity	$1.13*10^{-6}$	$1.06*10^{-3}$
maleID	FA_B	$1.35*10^{-6}$	$1.16*10^{-3}$
maleID	tenure	$3.63*10^{-8}$	$1.90*10^{-4}$
groupID	intercept	$7.33*10^{-9}$	$8.56*10^{-5}$
groupID	dominance rank	$6.73*10^{-8}$	$2.59*10^{-4}$
groupID	group mating activity	$4.13*10^{-6}$	$2.03*10^{-3}$
groupID	FA_B	$9.11*10^{-7}$	$9.55*10^{-4}$
groupID	tenure	$3.46*10^{-8}$	$1.86*10^{-4}$

’term’ states whether random effect is a random intercept (intercept) or slope for a predictor by stating the predictor.

Table S4 Confidence intervals (CI, 95%) of estimates for RWB genital display model

	estimate	**lCI**	**uCI**
intercept	0.009	-0.252	0.207
CONTRAST_RW [(a)]	0.053	-0.157	0.243
FA_B	-0.183	-0.354	-0.018
FA_LUM	-0.077	-0.247	0.082
FA_R	0.033	-0.138	0.233
dominance rank[(b)]	0.475	0.289	0.697
tenure[(c)]	-0.186	-0.370	0.052
group mating activity [(d)]	-0.156	-0.304	0.015

Estimate - estimated coefficients for the predictors, lCI - lower CI (2.5%), uCI - upper CI (97.5%). [(a)] square root-transformed and z-transformed, original mean±SD = 0.053±0.023; [(b)] z-transformed, original mean±SD = 0.495±0.326; [(c)] log-transformed and z-transformed, original mean±SD = 599.701±637.354; [(d)] square root-transformed and z-transformed, original mean±SD = 0.043±0.031 .

Table S5 Results of the reduced RWB genital display frequency model (GLMM with Poisson distribution) only including displays within male-male dominance context. Estimate - estimated coefficients for the predictors, SE - standard error, lCI – lower confidence interval, uCI - upper confidence interval, χ^2 – Chi-square test value, p – p-value. No autocorrelation term was needed

term	**estimate**	**SE**	**lCI**	**uCI**	**χ^2 [(a)]**	**p**
intercept	-2.406	0.320	-3.377	-1.957	NA[(b)]	NA[(b)]
dominance rank[(c)]	1.425	0.250	1.015	2.086	11.567	<0.001
tenure[(d)]	-0.249	0.184	-0.679	0.169	1.7721	0.183
group mating activity [(e)]	-0.098	0.161	-0.409	0.212	0.3711	0.542

[(a)] degrees of freedom are 1; [(b)] not shown due to limited interpretability; [(c)] z-transformed, original mean±SD = 0.495±0.326; [(d)] log-transformed and z-transformed, original mean±SD = 599.701±637.354; [(e)] square root-transformed and z-transformed, original mean±SD = 0.043±0.031; * significant p-value; ˙ p-value indicating a trend.

Table S6 Individual range of normalized color variables RED and BLUE with min – lowest value, max – highest value, mean – average and SD – standard deviation

	RED				BLUE			
maleID	**min**	**max**	**mean**	**SD**	**min**	**max**	**mean**	**SD**
M1	0.658	0.835	0.740	0.067	0.229	0.540	0.404	0.111
M2	0.556	0.784	0.697	0.085	0.206	0.786	0.457	0.139
M3	0	0.642	0.362	0.210	0.360	1	0.629	0.271
M4	0.149	0.635	0.382	0.244	0.588	0.769	0.661	0.095
M5	0.298	0.822	0.650	0.180	0.287	0.597	0.395	0.138
M6	0.090	0.406	0.270	0.163	0.416	0.744	0.569	0.165
M7	0.433	0.612	0.523	0.073	0.393	0.900	0.639	0.256
M8	0.211	0.323	0.264	0.057	0	0.847	0.512	0.410
M9	0.005	0.922	0.400	0.390	0.240	0.525	0.407	0.122
M10	0.284	0.641	0.479	0.128	0.328	0.914	0.645	0.217
M11	0.242	0.741	0.545	0.158	0.110	0.698	0.555	0.169
M12	0.330	0.572	0.451	0.171	0.451	0.742	0.597	0.206
M13	0.478	0.992	0.647	0.242	0.407	0.841	0.694	0.198
M14	0.578	0.807	0.718	0.115	0.494	0.603	0.537	0.043
M15	0.483	0.865	0.652	0.152	0.244	0.644	0.358	0.165
M16	0.486	0.839	0.661	0.130	0.177	0.908	0.581	0.223
M17	0.415	1	0.679	0.296	0.257	0.364	0.328	0.062
M18	0.285	0.444	0.375	0.062	0.261	0.764	0.479	0.174
M19	0.437	0.694	0.555	0.130	0.329	0.502	0.437	0.094
M20	0.125	0.445	0.240	0.178	0.511	0.915	0.701	0.203

Table S7 Individual range of normalized color variables LUM_R and LUM_B with min – lowest value, max – highest value, mean – average and SD – standard deviation

	LUM_R				LUM_B			
maleID	**min**	**max**	**mean**	**SD**	**min**	**max**	**mean**	**SD**
M1	0.032	0.424	0.163	0.159	0.190	0.508	0.330	0.144
M2	0.029	0.178	0.126	0.058	0.288	0.647	0.442	0.148
M3	0.048	1	0.496	0.337	0	0.497	0.306	0.183
M4	0.020	0.282	0.154	0.131	0.241	0.341	0.293	0.050
M5	0.060	0.465	0.184	0.143	0.236	0.802	0.517	0.202
M6	0	0.955	0.363	0.517	0.249	0.512	0.344	0.146
M7	0.122	0.271	0.200	0.079	0.279	0.368	0.315	0.041
M8	0.190	0.412	0.293	0.112	0.230	0.644	0.455	0.180
M9	0.116	0.642	0.348	0.246	0.409	1	0.644	0.254
M10	0.025	0.439	0.274	0.178	0.176	0.623	0.343	0.175
M11	0.083	0.583	0.297	0.185	0.222	0.624	0.391	0.139
M12	0.131	0.419	0.275	0.204	0.267	0.492	0.380	0.159
M13	0.015	0.088	0.047	0.030	0.226	0.444	0.288	0.105
M14	0.010	0.128	0.063	0.051	0.213	0.609	0.354	0.163
M15	0.044	0.417	0.189	0.147	0.349	0.580	0.438	0.089
M16	0.023	0.382	0.210	0.129	0.078	0.434	0.308	0.119
M17	0.032	0.305	0.125	0.155	0.178	0.380	0.304	0.110
M18	0.156	0.545	0.304	0.139	0.346	0.637	0.477	0.105
M19	0.066	0.175	0.112	0.057	0.452	0.629	0.567	0.099
M20	0.264	0.475	0.351	0.111	0.267	0.276	0.272	0.004

Table S8 Individual range of normalized color variables CONTRAST_RW, CONTRAST_RB and CONTRAST_WB with min – lowest value, max – highest value, mean – average and SD – standard deviation

	CONTRAST_RW				CONTRAST_RB				CONTRAST_WB			
maleID	**min**	**max**	**mean**	**SD**	**min**	**max**	**mean**	**SD**	**min**	**max**	**mean**	**SD**
M1	0.175	0.649	0.464	0.187	0.052	0.408	0.281	0.152	0.239	0.449	0.293	0.088
M2	0.216	0.883	0.379	0.284	0.255	0.844	0.405	0.253	0.160	0.941	0.401	0.308
M3	0.043	0.743	0.396	0.211	0	1	0.475	0.329	0.060	1	0.510	0.293
M4	0.207	0.925	0.647	0.385	0.272	0.543	0.385	0.141	0	0.435	0.246	0.223
M5	0.150	0.646	0.378	0.146	0.164	0.829	0.408	0.240	0.175	0.972	0.420	0.283
M6	0.050	0.543	0.277	0.249	0.212	0.580	0.372	0.189	0.173	0.578	0.353	0.207
M7	0.144	0.710	0.401	0.235	0.225	0.569	0.413	0.171	0.247	0.449	0.345	0.087
M8	0.223	0.283	0.255	0.030	0.080	0.410	0.283	0.178	0.049	0.416	0.271	0.195
M9	0.275	0.661	0.486	0.161	0.244	0.572	0.399	0.150	0.371	0.596	0.484	0.096
M10	0	0.712	0.382	0.293	0.067	0.720	0.486	0.249	0.131	0.632	0.383	0.209
M11	0.238	0.975	0.520	0.260	0.140	0.687	0.478	0.153	0.251	0.652	0.423	0.115
M12	0.018	0.688	0.353	0.474	0.184	0.781	0.483	0.422	0.252	0.579	0.416	0.231
M13	0.061	1	0.429	0.423	0.255	0.451	0.361	0.084	0.141	0.506	0.380	0.164
M14	0.109	0.274	0.216	0.066	0.168	0.669	0.351	0.202	0.193	0.742	0.450	0.199
M15	0.114	0.672	0.400	0.233	0.161	0.492	0.296	0.122	0.117	0.368	0.216	0.100
M16	0.196	0.530	0.326	0.132	0.104	0.628	0.401	0.231	0.103	0.718	0.407	0.236
M17	0.104	0.254	0.191	0.078	0.101	0.221	0.179	0.068	0.134	0.212	0.182	0.042
M18	0.142	0.490	0.263	0.131	0.180	0.870	0.481	0.241	0.234	0.867	0.499	0.235
M19	0.216	0.579	0.344	0.203	0.350	0.539	0.430	0.097	0.489	0.583	0.527	0.049
M20	0.143	0.513	0.302	0.191	0.336	0.599	0.448	0.136	0.330	0.472	0.408	0.072

Table S9 Full-null model comparisons of inter-individual differences models (LMMs) for the full data sets and the data subsets. N – number of data points (recording days), χ^2 – Chi-square test value, df – degrees of freedom, p – p-value, at – autocorrelation term included (yes/no), R^2_{mar} – marginal R^2 value for the fixed effects, R^2_{con} – conditional R^2 value for the whole model

full data set	**response**	**N**	**χ^2**	**df**	**p**	**at**	**R^2_{mar}**	**R^2_{con}**
	RED	93	3.023	5	0.697	no	0.133	0.538
	BLUE	95	3.260	5	0.660	no	0.049	0.249
	LUM_R	93	3.250	5	0.662	yes	0.091	0.272
	LUM_B	95	6.711	5	0.243	no	0.111	0.295
	CONTRAST_RW	92	6.909	5	0.228	no	0.088	0.097
	CONTRAST_RB	93	5.614	5	0.346	no	0.082	0.187
	CONTRAST_WB	92	3.832	5	0.574	no	0.094	0.243
data subset								
	RED	77	5.512	4	0.239	no	0.157	0.542
	BLUE	78	5.422	4	0.247	no	0.195	0.302
	LUM_R	77	1.912	4	0.752	yes	0.126	0.294
	LUM_B	78	3.931	4	0.416	no	0.135	0.405
	CONTRAST_RW	76	0.729	4	0.948	no	0.088	0.125
	CONTRAST_RB	77	4.544	4	0.337	no	0.096	0.096
	CONTRAST_WB	76	3.190	4	0.527	no	0.103	0.304

Table 10 Full-null model comparisons of intra-individual variation models (LMMs) for the full data sets and the data subsets. N – number of data points (recording days), χ^2 – Chi-square test value, df – degrees of freedom, p – p-value, at – autocorrelation term included (yes/no), R^2_{mar} – marginal R^2 value for the fixed effects, R^2_{con} – conditional R^2 value for the whole model

full data set								
	response	**N**	**χ^2**	**df**	**p**	**at**	**R^2_{mar}**	**R^2_{con}**
	RED	93	2.344	5	0.800	no	0.158	0.220
	BLUE	95	2.378	5	0.795	no	0.024	0.219
	LUM_R	93	0.733	5	0.981	yes	0.045	0.115
	LUM_B	95	3.721	5	0.590	no	0.056	0.056
	CONTRAST_RW	92	6.974	5	0.223	no	0.107	0.107
	CONTRAST_RB	93	6.712	5	0.243	no	0.083	0.132
	CONTRAST_WB	92	3.418	5	0.636	no	0.081	0.155
data subset								
	RED	77	5.371	4	0.251	no	0.236	0.236
	BLUE	78	1.242	4	0.871	no	0.069	0.126
	LUM_R	77	3.525	4	0.474	yes	0.125	0.125
	LUM_B	78	3.360	4	0.499	no	0.072	0.072
	CONTRAST_RW	76	3.306	4	0.508	no	0.122	0.122
	CONTRAST_RB	77	1.866	4	0.760	no	0.083	0.125
	CONTRAST_WB	76	4.603	4	0.331	no	0.122	0.158

Table S11 RED model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (full data set)

response: RED	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.217	0.012	18.475	0.183	0.246	-0.001	0.004	-0.131	-0.012	0.008
tenure[(a)]	0.005	0.008	0.596	-0.013	0.023	0.004	0.005	0.939	-0.005	0.014
age (young)	-0.012	0.027	-0.457	-0.086	0.065	0.009	0.010	0.878	-0.012	0.034
injury (yes)	-0.007	0.015	-0.497	-0.049	0.041	0.000	0.013	-0.015	-0.040	0.056
dominance rank[(b)]	0.012	0.009	1.352	-0.007	0.030	0.002	0.005	0.441	-0.008	0.012
group mating activity[(c)]	0.017	0.005	3.059	-0.001	0.029	0.018	0.004	4.027	0.003	0.027
autocorrelation	/	/	/	/	/	/	/	/	/	/
dominance rank[(b)]*group mating activity[(c)]	-0.004	0.005	-0.879	-0.016	0.007	-0.004	0.004	-1.027	-0.014	0.005

Reference levels of categorical factors are ‘prime’ (age) and ‘no’ (injury). Estimate - estimated coefficients for the predictors with estimates for categorical factors representing effects relative to reference level, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] inter-individual: log-transformed and z-transformed, intra-individual: square root-transformed and z-transformed, original mean±SD =605.719±637.924; [(b)] z-transformed, original mean±SD = 0.495±0.327; [(c)] square root-transformed and z-transformed, original mean±SD = 0.058±0.056

Table S12 BLUE model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (full data set)

response: BLUE	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.151	0.007	21.069	0.134	0.169	0.002	0.006	0.284	-0.012	0.015
tenure[(a)]	-0.008	0.008	-0.961	-0.025	0.013	0.000	0.007	0.014	-0.014	0.014
age (young)	-0.016	0.016	-1.017	-0.051	0.027	0.004	0.014	0.284	-0.026	0.035
injury (yes)	0.012	0.028	0.431	-0.056	0.088	0.004	0.024	0.167	-0.061	0.071
dominance rank[(b)]	-0.008	0.008	-0.989	-0.030	0.014	0.006	0.007	0.930	-0.010	0.021
group mating activity[(c)]	0.003	0.009	0.332	-0.030	0.030	0.002	0.006	0.302	-0.014	0.016
autocorrelation	/	/	/	/	/	/	/	/	/	/
dominance rank[(b)]*group mating activity[(c)]	-0.007	0.006	-1.087	-0.022	0.007	-0.007	0.005	-1.334	-0.020	0.004

Reference levels of categorical factors are ‘prime’ (age) and ‘no’ (injury). Estimate - estimated coefficients for the predictors with estimates for categorical factors representing effects relative to reference level, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] inter-individual: log-transformed and z-transformed, intra-individual: square root-transformed and z-transformed, original mean±SD =605.719±637.924; [(b)] z-transformed, original mean±SD = 0.495±0.327; [(c)] square root-transformed and z-transformed, original mean±SD = 0.058±0.056

Table S13 LUM_R model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (full data set)

response: LUM_R	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	-2.259	0.059	-38.138	-2.445	-2.074	0.001	0.005	0.173	-0.009	0.012
tenure[(a)]	-0.035	0.058	-0.614	-0.156	0.143	-0.001	0.006	-0.261	-0.013	0.011
age (young)	0.023	0.130	0.174	-0.301	0.429	-0.001	0.012	-0.063	-0.028	0.024
injury (yes)	0.165	0.130	1.270	-0.122	0.645	0.005	0.016	0.299	-0.029	0.050
dominance rank[(b)]	0.046	0.059	0.777	-0.088	0.191	0.001	0.006	0.098	-0.011	0.012
group mating activity[(c)]	-0.112	0.046	-2.466	-0.210	-0.101	-0.009	0.005	-1.823	-0.020	0.002
autocorrelation	0.049	0.044	1.103	-0.041	0.142	0.003	0.005	0.526	-0.008	0.014
dominance rank[(b)]*group mating activity[(c)]	-0.039	0.039	-1.001	-0.121	0.047	-0.003	0.004	-0.730	-0.012	0.008

Reference levels of categorical factors are ‘prime’ (age) and ‘no’ (injury). Estimate - estimated coefficients for the predictors with estimates for categorical factors representing effects relative to reference level, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] inter-individual: log-transformed and z-transformed, intra-individual: square root-transformed and z-transformed, original mean±SD =605.719±637.924; [(b)] z-transformed, original mean±SD = 0.495±0.327; [(c)] square root-transformed and z-transformed, original mean±SD = 0.058±0.056

Table S14 LUM_B model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (full data set)

response: LUM_B	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.342	0.014	23.828	0.309	0.381	0.001	0.010	0.143	-0.019	0.023
tenure[(a)]	-0.007	0.016	-0.414	-0.049	0.041	-0.003	0.011	-0.248	-0.024	0.021
age (young)	0.045	0.032	1.394	-0.048	0.126	-0.009	0.023	-0.372	-0.054	0.037
injury (yes)	0.053	0.031	1.677	-0.018	0.133	0.047	0.026	1.762	-0.006	0.099
dominance rank[(b)]	0.034	0.021	1.619	-0.023	0.099	0.007	0.011	0.622	-0.016	0.028
group mating activity[(c)]	-0.015	0.012	-1.258	-0.041	0.013	-0.016	0.010	-1.544	-0.037	0.005
autocorrelation	/	/	/	/	/	/	/	/	/	/
dominance rank[(b)]*group mating activity[(c)]	-0.007	0.010	-0.722	-0.031	0.016	-0.005	0.008	-0.537	-0.021	0.015

Reference levels of categorical factors are ‘prime’ (age) and ‘no’ (injury). Estimate - estimated coefficients for the predictors with estimates for categorical factors representing effects relative to reference level, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] inter-individual: log-transformed and z-transformed, intra-individual: square root-transformed and z-transformed, original mean±SD =605.719±637.924; [(b)] z-transformed, original mean±SD = 0.495±0.327; [(c)] square root-transformed and z-transformed, original mean±SD = 0.058±0.056

Table S15 CONTRAST_RW model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (full data set)

response: CONTRAST_RW	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	-3.030	0.045	-66.987	-3.140	-2.936	0.000	0.002	0.104	-0.004	0.004
tenure[(a)]	-0.009	0.049	-0.189	-0.130	0.097	-0.003	0.002	-1.116	-0.007	0.004
age (young)	-0.080	0.103	-0.769	-0.298	0.168	-0.002	0.005	-0.337	-0.015	0.012
injury (yes)	0.139	0.147	0.943	-0.207	0.783	0.006	0.006	1.063	-0.005	0.034
dominance rank[(b)]	0.066	0.050	1.334	-0.047	0.197	0.002	0.002	0.769	-0.003	0.007
group mating activity [(c)]	0.013	0.047	0.283	-0.089	0.121	0.002	0.002	0.998	-0.002	0.007
autocorrelation	/	/	/	/	/	/	/	/	/	/
dominance rank[(b)]* group mating activity [(c)]	-0.092	0.040	-2.318	-0.181	-0.005	-0.005	0.002	-2.609	-0.008	-0.001

Reference levels of categorical factors are ‘prime’ (age) and ‘no’ (injury). Estimate - estimated coefficients for the predictors with estimates for categorical factors representing effects relative to reference level, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] inter-individual: log-transformed and z-transformed, intra-individual: square root-transformed and z-transformed, original mean±SD =605.719±637.924; [(b)] z-transformed, original mean±SD = 0.495±0.327; [(c)] square root-transformed and z-transformed, original mean±SD = 0.058±0.056

Table S16 CONTRAST_RB model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (full data set)

response: CONTRAST_RB	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.149	0.006	25.599	0.137	0.162	0.001	0.005	0.216	-0.011	0.013
tenure[(a)]	-0.002	0.006	-0.366	-0.015	0.012	-0.001	0.006	-0.130	-0.013	0.013
age (young)	-0.007	0.014	-0.548	-0.042	0.025	-0.002	0.013	-0.135	-0.034	0.028
injury (yes)	0.036	0.018	1.950	-0.006	0.040	0.030	0.016	1.825	-0.006	0.034
dominance rank[(b)]	0.006	0.009	0.614	-0.019	0.031	0.008	0.006	1.165	-0.010	0.009
group mating activity[(c)]	-0.001	0.007	-0.164	-0.023	0.018	-0.002	0.006	-0.414	-0.016	0.009
autocorrelation	/	/	/	/	/	/	/	/	/	/
dominance rank[(b)]*group mating activity[(c)]	-0.008	0.005	-1.477	-0.020	0.004	-0.008	0.005	-1.698	-0.021	0.002

Reference levels of categorical factors are ‘prime’ (age) and ‘no’ (injury). Estimate - estimated coefficients for the predictors with estimates for categorical factors representing effects relative to reference level, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] inter-individual: log-transformed and z-transformed, intra-individual: square root-transformed and z-transformed, original mean±SD =605.719±637.924; [(b)] z-transformed, original mean±SD = 0.495±0.327; [(c)] square root-transformed and z-transformed, original mean±SD = 0.058±0.056

Table S17 CONTRAST_WB model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (full data set)

response: CONTRAST_WB	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.346	0.009	38.900	0.324	0.370	0.002	0.005	0.284	-0.010	0.014
tenure[(a)]	-0.002	0.010	-0.192	-0.024	0.022	0.001	0.006	0.085	-0.013	0.013
age (young)	0.022	0.020	1.099	-0.050	0.076	-0.002	0.013	-0.135	-0.033	0.026
injury (yes)	0.031	0.026	1.179	-0.040	0.091	0.028	0.018	1.600	-0.013	0.067
dominance rank[(b)]	0.020	0.012	1.597	-0.017	0.063	0.007	0.006	1.083	-0.011	0.024
group mating activity[(c)]	-0.019	0.018	-1.083	-0.075	0.033	-0.011	0.006	-1.991	-0.026	0.003
autocorrelation	/	/	/	/	/	/	/	/	/	/
dominance rank[(b)]*group mating activity[(c)]	0.003	0.008	0.318	-0.020	0.032	-0.002	0.005	-0.363	-0.017	0.010

Reference levels of categorical factors are ‘prime’ (age) and ‘no’ (injury). Estimate - estimated coefficients for the predictors with estimates for categorical factors representing effects relative to reference level, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] inter-individual: log-transformed and z-transformed, intra-individual: square root-transformed and z-transformed, original mean±SD =605.719±637.924; [(b)] z-transformed, original mean±SD = 0.495±0.327; [(c)] square root-transformed and z-transformed, original mean±SD = 0.058±0.056

Table S18 RED model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (reduced data set)

response: RED	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.228	0.012	18.616	0.194	0.257	0.001	0.005	0.139	-0.009	0.010
mean fGCM[(a)]	-0.004	0.007	-0.601	-0.022	0.011	-0.002	0.005	-0.383	-0.017	0.010
dominance rank[(b)]	0.009	0.009	0.947	-0.011	0.028	0.004	0.005	0.733	-0.007	0.014
group mating activity[(c)]	0.019	0.007	2.680	0.004	0.035	0.018	0.005	3.299	0.006	0.029
autocorrelation term	/	/	/	/	/	/	/	/	/	/
mean fGCM[(a)] * dominance rank[(b)]	-0.011	0.006	-1.771	-0.025	0.002	-0.009	0.005	-1.828	-0.022	0.001
mean fGCM[(a)] * group mating activity[(c)]	0.002	0.005	0.420	-0.009	0.015	-0.001	0.004	-0.233	-0.010	0.008
dominance rank[(b)] * group mating activity[(c)]	0.004	0.006	0.619	-0.010	0.017	0.003	0.005	0.584	-0.008	0.013
mean fGCM[(a)] * dominance rank[(b)] group mating activity[(c)]	-0.004	0.004	-0.913	-0.013	0.005	-0.004	0.004	-1.080	-0.011	0.003

Estimate - estimated coefficients for the predictors, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] log-transformed and z-transformed, original mean±SD = 47.289±45.115; [(b)] z-transformed, original mean±SD = 0.551±0.316; [(c)] square root-transformed and z-transformed, original mean±SD = 0.060±0.059

Table S19 BLUE model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (reduced data set)

response: BLUE	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.155	0.008	19.341	0.136	0.176	0.005	0.006	0.828	-0.008	0.018
mean fGCM[(a)]	0.016	0.008	1.984	-0.005	0.032	0.001	0.010	0.049	-0.032	0.027
dominance rank[(b)]	-0.008	0.011	-0.754	-0.033	0.018	0.004	0.006	0.661	-0.010	0.021
group mating activity[(c)]	0.008	0.008	1.036	-0.012	0.026	0.005	0.007	0.764	-0.010	0.019
autocorrelation term	/	/	/	/	/	/	/	/	/	/
mean fGCM[(a)] * dominance rank[(b)]	-0.008	0.008	-1.049	-0.026	0.010	-0.002	0.007	-0.328	-0.020	0.015
mean fGCM[(a)] * group mating activity[(c)]	-0.012	0.007	-1.808	-0.026	0.001	-0.005	0.006	-0.813	-0.017	0.007
dominance rank[(b)] * group mating activity[(c)]	-0.017	0.007	-2.320	-0.034	-0.002	-0.012	0.006	-1.923	-0.025	0.001
mean fGCM[(a)] * dominance rank[(b)] * group mating activity[(c)]	0.003	0.005	0.641	-0.009	0.016	0.003	0.005	0.690	-0.006	0.013

Estimate - estimated coefficients for the predictors, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] log-transformed and z-transformed, original mean±SD = 47.289±45.115; [(b)] z-transformed, original mean±SD = 0.551±0.316; [(c)] square root-transformed and z-transformed, original mean±SD = 0.060±0.059

Table S20 LUM_R model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (reduced data set)

response: LUM_R	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	-2.295	0.064	-35.878	-2.454	-2.100	0.000	0.005	0.073	-0.009	0.009
mean fGCM[(a)]	0.032	0.052	0.612	-0.077	0.160	0.006	0.005	1.247	-0.004	0.016
dominance rank[(b)]	0.058	0.060	0.968	-0.072	0.213	0.002	0.005	0.347	-0.008	0.011
group mating activity[(c)]	-0.113	0.054	-2.102	-0.254	0.013	-0.010	0.005	-2.050	-0.021	0.000
autocorrelation term	0.034	0.043	0.777	0.023	0.127	0.002	0.004	0.344	-0.007	0.010
mean fGCM[(a)] * dominance rank[(b)]	0.034	0.049	0.688	-0.021	0.071	0.006	0.005	1.265	-0.005	0.016
mean fGCM[(a)] * group mating activity[(c)]	-0.011	0.041	-0.264	-0.032	0.022	0.001	0.004	0.250	-0.008	0.010
dominance rank[(b)] * group mating activity[(c)]	-0.082	0.049	-1.657	-0.102	-0.026	-0.009	0.005	-1.889	-0.019	0.001
mean fGCM[(a)] * dominance rank[(b)] * group mating activity[(c)]	0.024	0.034	0.716	0.007	0.067	0.002	0.003	0.552	-0.005	0.008

Estimate - estimated coefficients for the predictors, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] log-transformed and z-transformed, original mean±SD = 47.289±45.115; [(b)] z-transformed, original mean±SD = 0.551±0.316; [(c)] square root-transformed and z-transformed, original mean±SD = 0.060±0.059

Table S21 LUM_B model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (reduced data set)

response: LUM_B	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	-1.118	0.037	-29.839	-1.202	-1.018	0.006	0.011	0.532	-0.017	0.028
mean fGCM[(a)]	-0.061	0.038	-1.589	-0.159	0.057	0.002	0.012	0.184	-0.027	0.025
dominance rank[(b)]	0.089	0.087	1.032	-0.152	0.351	0.008	0.012	0.692	-0.015	0.034
group mating activity[(c)]	0.013	0.047	0.281	-0.116	0.026	-0.012	0.012	-0.998	-0.041	0.012
autocorrelation term	/	/	/	/	/	/	/	/	/	/
mean fGCM[(a)] * dominance rank[(b)]	0.033	0.037	0.893	-0.046	0.140	0.017	0.011	1.483	-0.005	0.041
mean fGCM[(a)] * group mating activity[(c)]	-0.040	0.043	-0.936	-0.167	0.064	-0.011	0.010	-1.121	-0.032	0.009
dominance rank[(b)] * group mating activity[(c)]	-0.062	0.054	-1.158	-0.177	0.073	-0.009	0.011	-0.844	-0.033	0.012
mean fGCM[(a)] * dominance rank[(b)] * group mating activity[(c)]	-0.008	0.036	-0.234	-0.102	0.068	-0.008	0.008	-0.925	-0.024	0.009

Estimate - estimated coefficients for the predictors, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] log-transformed and z-transformed, original mean±SD = 47.289±45.115; [(b)] z-transformed, original mean±SD = 0.551±0.316; [(c)] square root-transformed and z-transformed, original mean±SD = 0.060±0.059

Table S22 CONTRAST_RW model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (reduced data set)

response: CONTRAST_RW	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	-3.037	0.057	-52.883	-3.184	-2.914	-0.001	0.002	-0.207	-0.005	0.005
mean fGCM[(a)]	0.012	0.065	0.184	-0.120	0.158	0.002	0.003	0.727	-0.004	0.008
dominance rank[(b)]	0.074	0.060	1.222	-0.048	0.223	0.002	0.003	0.946	-0.003	0.008
group mating activity[(c)]	-0.008	0.061	-0.130	-0.137	0.007	0.000	0.003	-0.121	-0.006	0.005
autocorrelation term	/	/	/	/	/	/	/	/	/	/
mean fGCM[(a)] * dominance rank[(b)]	-0.018	0.067	-0.272	-0.158	0.122	0.002	0.003	0.721	-0.004	0.008
mean fGCM[(a)] * group mating activity[(c)]	0.021	0.047	0.448	-0.090	0.116	0.002	0.002	0.746	-0.003	0.006
dominance rank[(b)] * group mating activity[(c)]	-0.076	0.057	-1.317	-0.189	0.053	-0.004	0.003	-1.439	-0.009	0.001
mean fGCM[(a)] * dominance rank[(b)] * group mating activity[(c)]	-0.020	0.040	-0.511	-0.104	0.070	-0.003	0.002	-1.427	-0.006	0.001

Estimate - estimated coefficients for the predictors, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] log-transformed and z-transformed, original mean±SD = 47.289±45.115; [(b)] z-transformed, original mean±SD = 0.551±0.316; [(c)] square root-transformed and z-transformed, original mean±SD = 0.060±0.059

Table S23 CONTRAST_WB model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (reduced data set)

response: CONTRAST_WB	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.346	0.010	33.338	0.320	0.370	1.002	0.003	334.099	0.996	1.009
mean fGCM[(a)]	-0.003	0.012	-0.270	-0.030	0.023	-0.003	0.005	-0.579	-0.019	0.010
dominance rank[(b)]	0.023	0.017	1.351	-0.023	0.075	0.003	0.003	0.936	-0.004	0.014
group mating activity[(c)]	-0.004	0.020	-0.186	-0.062	0.001	-0.001	0.003	-0.204	-0.010	0.006
autocorrelation term	/	/	/	/	/	/	/	/	/	/
mean fGCM[(a)] * dominance rank[(b)]	0.007	0.012	0.531	-0.021	0.033	0.001	0.004	0.391	-0.007	0.011
mean fGCM[(a)] * group mating activity[(c)]	-0.015	0.010	-1.491	-0.043	0.007	-0.005	0.003	-1.907	-0.005	0.001
dominance rank[(b)] * group mating activity[(c)]	-0.008	0.013	-0.594	-0.038	0.029	-0.004	0.003	-1.396	-0.005	-0.004
mean fGCM[(a)] * dominance rank[(b)] * group mating activity[(c)]	-0.008	0.008	-0.893	-0.027	0.019	0.002	0.002	0.731	-0.004	0.006

Estimate - estimated coefficients for the predictors, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] log-transformed and z-transformed, original mean±SD = 47.289±45.115; [(b)] z-transformed, original mean±SD = 0.551±0.316; [(c)] square root-transformed and z-transformed, original mean±SD = 0.060±0.059

Table S24 CONTRAST_RB model results and confidence intervals (CI, 95%) of the inter-individual differences and intra-individual variation models (reduced data set)

response: CONTRAST_RB	**inter-individual**					**intra-individual**				
	estimate	**SE**	**t-value**	**lCI**	**uCI**	**estimate**	**SE**	**t-value**	**lCI**	**uCI**
intercept	0.154	0.007	23.312	0.140	0.170	0.005	0.006	0.777	-0.008	0.017
mean fGCM[(a)]	0.004	0.007	0.616	-0.013	0.021	0.001	0.009	0.088	-0.026	0.024
dominance rank[(b)]	0.000	0.007	-0.029	-0.015	0.018	0.006	0.006	0.986	-0.007	0.023
group mating activity[(c)]	0.007	0.007	0.995	-0.011	0.023	0.001	0.007	0.193	-0.014	0.015
autocorrelation term	/	/	/	/	/	/	/	/	/	/
mean fGCM[(a)] * dominance rank[(b)]	-0.003	0.007	-0.476	-0.016	0.011	0.002	0.007	0.243	-0.014	0.017
mean fGCM[(a)] * group mating activity[(c)]	-0.012	0.006	-2.038	-0.024	0.000	-0.007	0.006	-1.321	-0.019	0.005
dominance rank[(b)] * group mating activity[(c)]	-0.011	0.007	-1.644	-0.026	0.003	-0.013	0.006	-2.034	-0.026	0.000
mean fGCM[(a)] * dominance rank[(b)] * group mating activity[(c)]	0.002	0.005	0.458	-0.007	0.012	0.001	0.004	0.270	-0.008	0.010

Estimate - estimated coefficients for the predictors, SE - standard error, t-value – test statistics, lCI - lower CI (2.5%), uCI - upper CI (97.5%), * between predictor terms indicating an included interaction. [(a)] log-transformed and z-transformed, original mean±SD = 47.289±45.115; [(b)] z-transformed, original mean±SD = 0.551±0.316; [(c)] square root-transformed and z-transformed, original mean±SD = 0.060±0.059

Supplemental figures

Figure caption

ESM2 - Fig. S1 RWB genital display with female social partner (standardized for lighting)

ESM3- Fig. S2 Frequency of RWB genital display shown per context in relation to total frequency of context behavior (dominance, grooming, inter-troop encounter, mating, locomotion, foraging)

ESM4- Fig. S3 Color value variation between six RWB genital display contexts. a) RED of perianal area, b) BLUE of scrotum, c) Luminance of red (LUM_R), d) Luminance of blue (LUM_B). Each circle indicates a RWB genital display event of one male

ESM5 - Fig. S4 Color value variation between six RWB genital display contexts. a) CONTRAST_RW, b) CONTRAST_RB, c) CONTRAST_WB. Each circle indicates a RWB genital display event of one male

ESM6 - Fig. S5 Non-metric multidimensional scaling (NMDS) plot of color variable similarities between RWB genital display contexts. Each dot indicates a RWB genital display event of one male. Each RWB genital display context is represented by one color. Axes are non-dimensional

ESM7 - Fig. S6 Absolute color value variation between and within males. a) RED of perianal area, b) BLUE of scrotum. RED and BLUE range from -1 to 1. The box indicates the 25th and 75th percentiles, the bars the minimum and maximum values, the bold line the median and the circles indicate outliers. Number of recording days per individual (N) is indicated in parenthesis, when more than one number of recording days is stated the first number is for figure a) and second for b)

ESM8 - Fig. S7 Absolute color value variation between and within males. a) Luminance of red (LUM_R), b) Luminance of blue (LUM_B). LUM_R and LUM_B range from 0 to 1. The box indicates the 25th and 75th percentiles, the bars the minimum and maximum values, the bold line the median and the circles indicate outliers. Number of recording days per individual (N) is indicated in parenthesis, when more than one number of recording days is stated the first number is for figure a) and second for b)

ESM9 - Fig. S8 Absolute color value variation between and within males. a) CONTRAST_RW, b) CONTRAST_RB, c) CONTRAST_WB. CONTRAST_RW, _RB and _WB range from 0 to infinity. The box indicates the 25th and 75th percentiles, the bars the minimum and maximum values, the bold line the median and the circles indicate outliers. Number of recording days per individual (N) is indicated in parenthesis, when more than one number of recording days is stated the first number is for figure a), second for b) and third for c)

ESM10 - Fig. S9 Color variation of perianal area a) redder and b) less red; and color variation of the scrotum c) bluer and d) less blue. Photos are standardized for lighting

References

Barr DJ, Levy R, Scheepers C, Tily HJ. 2013. Random effects structure for confirmatory hypothesis testing: Keep it maximal. J Mem Lang. 68(3):255–278. doi:10.1016/j.jml.2012.11.001.

Burnham KP, Anderson DR. 2002. Model selection and multimodel inference: a practical information-theoretic approach. New York: Springer US.

Cheney DL, Seyfarth RM. 2009. Chapter 1 Stress and Coping Mechanisms in Female Primates. In: H. Jane Brockmann TJR, editor. Advances in the Study of Behavior. Vol. Volume 39. Academic Press. p. 1–44. [accessed 2013 Mar 4]. http://www.sciencedirect.com/science/article/pii/S0065345409390014.

Gesquiere LR, Learn NH, Simao MCM, Onyango PO, Alberts SC, Altmann J. 2011. Life at the top: rank and stress in wild male baboons. Science. 333(6040):357–360. doi:10.1126/science.1207120.

Kulik L, Amici F, Langos D, Widdig A. 2015. Sex differences in the development of social relationships in rhesus macaques (*Macaca mulatta*). Int J Primatol. 36(2):353–376. doi:10.1007/s10764-015-9826-4.

R Core Team. 2015. A language and environment for statistical computing. Vienna, Austria: R Foundation for Statistical Computing,.

Sapolsky RM. 2005. The influence of social hierarchy on primate health. Science. 308(5722):648–652. doi:10.1126/science.1106477.

Schielzeth H. 2010. Simple means to improve the interpretability of regression coefficients. Methods Ecol Evol. 1(2):103–113. doi:10.1111/j.2041-210X.2010.00012.x.

Schielzeth H, Forstmeier W. 2009. Conclusions beyond support: overconfident estimates in mixed models. Behav Ecol. 20(2):416–420. doi:10.1093/beheco/arn145.