

955

Supplementary Methods956 **Site Descriptions**

957 **Living Links, Edinburgh Zoo.** Nineteen capuchins were from the ‘Living Links to
958 Human Evolution’ Research Centre at the Royal Zoological Society of Scotland, Edinburgh
959 Zoo, UK. These individuals were from two breeding groups, and each cohabited with a group
960 of common squirrel monkeys (*Saimiri sciureus*). At the time of this study, the ‘East’ group
961 ranged from 2-3 adult males, 3 adult females, 3 juveniles, and 0-5 infants. The ‘West’ group
962 ranged from 2 adult males, 3 adult females, 4-5 juveniles, and 2-5 infants. All monkeys were
963 captive born except the two eldest males, which were likely wild-born and came to Living
964 Links as established members of the groups. One individual was hand-reared. Both groups
965 were housed in identically designed, but mutually exclusive, 189m³ indoor enclosures with
966 natural light and near-permanent access to a ~900m² outdoor enclosure containing trees,
967 providing ample opportunity to engage in natural behaviors. All subjects received
968 commercial TrioMunch pellets supplemented with fresh fruits and vegetables three times
969 daily, and were given cooked chicken and hardboiled eggs once every week. Water was
970 available to the monkeys *ad libitum* at all times. Further details of housing and husbandry are
971 provided in Leonardi et al. (2010).

972 **Institut Pluridisciplinaire Hubert Curien, CNRS.** Eighteen capuchins belonged to
973 a single group (‘Arnaud’ group) at the Primatology Centre of the University of Strasbourg,
974 France, and consisted of 6 adult males, 12 adult females, 0 juveniles, and 0 infants. All
975 monkeys were captive born except for the eldest female, which was hand-reared and most
976 likely wild-born. The hand-reared female has been a member of Arnaud group since 1987.
977 Monkeys were provided commercial monkey diet pellets and water *ad libitum*, and received
978 fruit once a week. Monkeys were never food-deprived. All subjects were housed in an indoor
979 (99m³) and outdoor (45m²) enclosure, consisting of multiple compartments.

980 **Language Research Center, Georgia State University.** Twelve capuchins belonged
981 to two groups at the Georgia State University (GSU) in Atlanta, Georgia, USA. The ‘Griffin’
982 group consisted of 2 adult males, 2 adult females, 2 juveniles, and 0 infants. The ‘Gabe’
983 group consisted of 1 adult male, 2 sub-adult males, 2 adult females, 1 juvenile, and 0 infants.
984 All monkeys were captive born. For both groups, enclosures consisted of an indoor room
985 (Gabe group: 75.84m³; Griffin group: 54.42m³) connected to a large outdoor enclosure (Gabe
986 group: 13.51m²; Griffin group: 21.15m²). Group members spent most of their time in the
987 outdoor area throughout the year, except when engaged in research, during bad weather, or
988 overnight. Monkeys were provided commercial monkey chow three times a day (morning,
989 noon, evening), and fruits and vegetables were given every evening. Water was available *ad*
990 *libitum* at all times, including during cognitive and behavioral testing. The enclosures were
991 made of chain link fencing and were equipped with swings, ropes, and other materials to
992 create three-dimensional living conditions to enrich the monkeys. The older study subjects
993 had previously been housed together in various combinations at Yerkes National Primate
994 Research Center, before being relocated to GSU 5 years ago.

995 **Bucknell Primate Lab, Bucknell University.** Fourteen of the primates belonged to a
996 single group at Bucknell University in Lewisburg, Pennsylvania, USA. They were housed in
997 one social group consisting of 2 adult males, 2 adult females, 5 sub-adult females, 5
998 juveniles, and 0 infants. All monkeys were captive born. The enclosure consisted of a series
999 of seven compartments (totaling 630m³) made of caging wire, which were interconnected by
1000 doorways or tunnels also made of caging wire. The compartments included various perches,
1001 swings, and poles to ensure a most naturalistic environment for climbing and movement.
1002 Monkeys were provided commercial monkey chow twice per day (morning, evening), fruits
1003 and vegetables were given once per day (morning), and an afternoon snack consisting largely
1004 of peanuts, raisins, and low-sugar cereal was given in the afternoon. Water was available *ad*

1005 *libitum* at all times. The older subjects (N = 4) had previously been housed at Yerkes
1006 National Primate Research Center before being relocated to Bucknell University 12 years
1007 ago.

1008 **Living Links, Yerkes National Primate Research Center, USA.** Twenty-six brown
1009 capuchin monkeys housed in two separate social groups at Living Links, part of the Yerkes
1010 National Primate Research Center. One group consisted of 15 monkeys housed in 25 m², and
1011 the other of 11 monkeys in 31 m². Both groups had access to indoor and outdoor areas and
1012 were visually, but not acoustically isolated from each other. The monkeys received Purina
1013 monkey chow and water *ad libitum*, and trays containing fresh produce every evening.
1014 Monkeys were never food or water deprived and all procedures were approved by the
1015 Institutional Animal Care and Use Committee (IACUC) prior to the commencement of the
1016 study.

1017 **Laboratory of Comparative Ethology, National Institutes of Health.** Twenty-six
1018 capuchins came from two captive breeding group and several small bachelor groups at the
1019 Laboratory of Comparative Ethology, NICHD. At the time of the study, one group (Garth's
1020 group) comprised 5 adults (4 female and 1 male, aged 7-30 years) and 4 juveniles (2 female
1021 and 2 male, aged 1-3 years). Three infants (1 female and 2 male, aged <6 months) were part
1022 of the group but were not rated for the current study. The second breeding group (Manuel's
1023 group) comprised 4 adults (3 female and 1 male, aged 5-12 years) and 4 juveniles (1 female
1024 and 3 male, aged 2-4 years). A further nine animals were pair-housed in cages; two pairs and
1025 a group of 3 animals were subadult to adult males (aged 4-9 years), and one pair was an adult
1026 female with a juvenile male (aged 25 and 1 year respectively). All monkeys were captive
1027 born, mother-reared, and housed in the LCE primate facilities at the NIH Animal Center near
1028 Poolesville, MD. Breeding groups were housed in one or two parts of three indoor runs (6.9 x
1029 4.1 x 2.1m each) which were connected via sliding doors. Runs were furnished with swings,

1030 ladders and various platforms. Cage-housed monkeys were housed in quad cages (1.63 x 1.63
1031 x .71 m per pair). All monkeys were provided with a variety of plastic and metal
1032 manipulanda. Monkeys were not food deprived for this study, and received daily nutritional
1033 supplements of seeds and fresh fruit or nuts. Commercial monkey biscuits (Labdiet 5045) and
1034 water were available *ad libitum*.

1035 **Comparative Cognition Laboratory, Yale University.** Ten monkeys were at the
1036 Comparative Cognition Laboratory at Yale University, New Haven, Connecticut, USA. This
1037 group consisted of 4 adult males, 4 adult females, and 2 juvenile females. All monkeys were
1038 captive born. The monkeys were housed in an indoor enclosure (32 m³) consisting of multiple
1039 compartments. Commercial monkey pellets were provided twice daily (morning, afternoon)
1040 and supplemented with fruits, vegetables, nuts, and cereal daily. Water was available *ad*
1041 *libitum*.

1042

1043 Table S1

1044 *Structure Matrix of Varimax- and Promax-Rotated Component Loadings for the Six Component Solution*

	Varimax Rotated Components							Promax Rotated Components						
	Asst	Open	Attn	Neur	Socb	Enga	h^2	Asst	Open	Attn	Neur	Socb	Enga	h^2
Submissive	-.92	-.10	.01	-.15	-.18	.00	.90	-.93	.07	-.04	-.18	-.17	.07	.90
Bullying	.91	-.01	.06	-.18	-.06	.04	.88	.97	-.16	-.01	-.15	-.04	.00	.88
Aggressive	.90	.05	.07	-.19	-.08	.03	.86	.94	-.09	.00	-.15	-.07	-.01	.86
Stingy/Greedy	.86	.02	.04	-.17	.05	.21	.81	.90	-.13	.02	-.16	.08	.18	.81
Jealous	.80	.17	.03	-.21	.03	.26	.78	.80	.04	.00	-.21	.06	.23	.78
Gentle	-.79	-.11	-.15	.40	.11	.08	.84	-.85	.01	-.02	.36	.09	.09	.84
Dominant	.79	-.24	-.01	.06	.04	.42	.87	.85	-.39	.04	.07	.10	.39	.87
Vulnerable	-.79	-.07	.16	-.19	-.22	.04	.74	-.81	.08	.11	-.19	-.18	.11	.74
Timid	-.71	-.44	.10	-.28	-.21	-.05	.85	-.63	-.34	.00	-.31	-.14	.02	.85
Cautious	-.71	-.46	.05	-.14	-.13	.08	.76	-.64	-.37	.01	-.18	-.05	.15	.76
Manipulative	.63	.42	-.03	.02	.21	-.18	.66	.59	.31	-.03	.03	.15	-.23	.66
Fearful	-.62	-.32	.29	-.39	-.21	.00	.76	-.55	-.23	.19	-.39	-.10	.09	.76

	Varimax Rotated Components							Promax Rotated Components						
	Asst	Open	Attn	Neur	Soch	Enga	h^2	Asst	Open	Attn	Neur	Soch	Enga	h^2
Irritable	.62	-.05	.04	-.41	-.27	.15	.65	.67	-.12	-.11	-.40	-.25	.15	.65
Dependent/Follower	-.61	.12	.25	-.30	.28	-.24	.67	-.61	.16	.23	-.33	.35	-.15	.67
Independent	.61	.13	-.03	.48	-.28	.10	.71	.55	.12	.06	.59	-.35	.00	.71
Anxious	-.55	-.37	.26	-.34	-.41	-.01	.79	-.47	-.26	.14	-.32	-.32	.06	.79
Reckless	.51	.47	.48	-.13	.01	.21	.76	.43	.40	.53	-.04	.09	.22	.76
Autistic	-.43	-.24	.21	-.09	-.42	.05	.47	-.41	-.12	.15	-.04	-.38	.08	.47
Protective	.42	-.02	-.30	.23	.30	-.02	.41	.43	-.12	-.24	.19	.24	-.08	.41
Inventive	.12	.86	-.09	.12	.07	.22	.82	-.09	.90	-.03	.12	-.03	.19	.82
Inquisitive	.19	.84	.04	.05	.23	.18	.83	.00	.84	.13	.06	.18	.17	.83
Innovative	.07	.84	-.15	.08	.09	.20	.79	-.14	.89	-.11	.06	-.02	.18	.79
Playful	.08	.83	.11	-.09	.25	.02	.77	-.09	.83	.15	-.09	.21	.03	.77
Active	.05	.81	-.11	-.33	.24	-.08	.85	-.09	.82	-.19	-.39	.15	-.07	.85
Conventional	-.12	-.79	-.22	.17	.09	-.02	.72	.04	-.84	-.19	.12	.13	-.02	.72
Lazy	-.07	-.71	.32	.32	-.18	.06	.74	.06	-.72	.43	.42	-.05	.06	.74

	Varimax Rotated Components							Promax Rotated Components						
	Asst	Open	Attn	Neur	Soch	Enga	h^2	Asst	Open	Attn	Neur	Soch	Enga	h^2
Imitative	-.02	.68	-.05	-.04	.38	.03	.62	-.16	.67	.00	-.08	.34	.04	.62
Defiant	.48	.59	.25	-.07	-.13	.03	.66	.37	.58	.24	.02	-.16	.01	.66
Quitting	.00	-.40	.37	-.06	.01	-.31	.40	.13	-.46	.37	.01	.11	-.29	.40
Disorganized	-.22	.04	.79	-.07	-.26	-.08	.75	-.22	.10	.83	.09	-.12	-.02	.75
Unperceptive	.03	-.07	.78	-.10	-.08	-.01	.64	.08	-.10	.85	.04	.11	.04	.64
Thoughtless	-.12	.01	.74	-.15	-.16	.33	.72	-.12	.02	.82	-.03	.05	.41	.72
Distractible	.08	.01	.70	-.27	.31	-.25	.72	.16	-.10	.74	-.20	.49	-.18	.72
Clumsy	-.17	-.21	.68	.15	.06	-.15	.58	-.11	-.23	.81	.28	.22	-.10	.58
Erratic	.11	.30	.61	-.41	-.25	-.13	.72	.10	.31	.52	-.30	-.16	-.08	.72
Impulsive	.03	.46	.50	-.49	-.16	-.08	.73	-.02	.48	.40	-.42	-.09	-.02	.73
Helpful	-.22	.23	-.45	.34	.25	.14	.50	-.32	.27	-.35	.26	.14	.10	.50
Sensitive	-.29	-.06	-.38	.28	.29	.00	.40	-.32	-.04	-.30	.20	.22	-.02	.40
Intelligent	.09	.37	-.38	.29	.02	.03	.38	-.02	.41	-.34	.27	-.12	-.03	.38
Cool	.17	.04	-.30	.78	.14	.17	.78	.09	.02	-.08	.80	.05	.08	.78

	Varimax Rotated Components							Promax Rotated Components						
	Asst	Open	Attn	Neur	Soch	Enga	h^2	Asst	Open	Attn	Neur	Soch	Enga	h^2
Unemotional	.01	-.12	-.04	.75	.16	-.09	.61	-.01	-.13	.19	.81	.13	-.16	.61
Excitable	.00	.12	.54	-.63	-.03	-.07	.70	.05	.09	.42	-.60	.11	.02	.70
Predictable	-.08	-.43	-.05	.60	.05	.06	.56	-.05	-.43	.13	.64	.06	.02	.56
Sympathetic	-.35	.06	-.28	.49	.35	.02	.57	-.41	.08	-.11	.45	.29	.00	.57
Sociable	.21	.26	.05	.18	.82	.10	.84	.17	.10	.26	.12	.89	.11	.84
Solitary	-.39	-.33	.03	.02	-.74	-.16	.84	-.35	-.16	-.10	.10	-.79	-.16	.84
Affectionate	-.15	.14	-.02	.33	.74	.02	.70	-.19	.05	.21	.27	.78	.03	.70
Friendly	-.32	.22	-.24	.22	.69	.06	.74	-.38	.18	-.08	.11	.69	.07	.74
Depressed	-.44	-.35	.26	-.04	-.65	-.03	.81	-.40	-.19	.18	.05	-.62	.00	.81
Individualistic	-.07	.33	.29	.26	-.43	-.07	.46	-.17	.45	.32	.40	-.48	-.10	.46
Persistent	.27	.26	.03	-.07	-.01	.82	.81	.17	.23	.12	-.09	.06	.83	.81
Curious	.05	.46	.02	-.09	.19	.73	.79	-.09	.45	.12	-.15	.25	.76	.79
Decisive	.36	.08	-.32	.30	.07	.62	.72	.28	.03	-.20	.26	.04	.57	.72
Stable	-.02	-.13	-.24	.42	.16	.59	.62	-.07	-.14	-.05	.38	.17	.57	.62

	Varimax Rotated Components						Promax Rotated Components					
	Asst	Open	Attn	Neur	Socb	Enga	Asst	Open	Attn	Neur	Socb	Enga
SS loadings	11.02	8.39	5.74	5.11	4.84	2.98	10.91	8.39	5.54	5.39	4.94	2.90
Proportion of Variance	.20	.16	.11	.09	.09	.06	.20	.16	.10	.10	.09	.05

1045 Note. Salient loadings are in boldface. h^2 = communality. Asst = Assertiveness (reversed), Open = Openness, Attn = Attentiveness, Neur =

1046 Neuroticism, Socb = Sociability, Engag = Engagement.

1047

1048 Table S2

1049 Correlations Between Promax Rotated Components

	Assertiveness	Openness	Attentiveness	Neuroticism	Sociability
Openness	-.35				
Attentiveness	.02	-.05			
Neuroticism	-.05	.01	-.45		
Sociability	-.04	.26	-.38	.25	
Engagement	-.13	.03	-.17	.18	-.06

1050