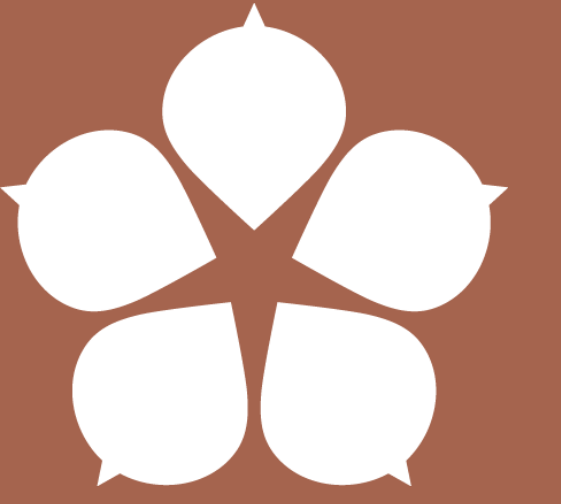


How long does it take? Reliable assessment of personality from everyday behaviour in cotton-top tamarins



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INTRODUCTION

Animal personality studies often investigate individual differences on a single personality trait like boldness. However, many species may exhibit consistent variation in more than one trait simultaneously. The behavioural coding method, based on recording frequencies and durations of behaviours, may represent a suitable tool for describing the entire hierarchically structured personality model. Traditionally, however, this approach has been considered time-consuming. Here we provide evaluation of behavioural coding of everyday behaviours as a method of personality assessment in a cooperatively breeding New World primate, the cotton-top tamarin (*Saguinus oedipus*).

STUDY QUESTIONS

- 1) Are everyday behaviours of cotton-top tamarins repeatable and consistent over time?
- 2) What are the main personality dimensions in cotton-top tamarin?
- 3) How many hours of observation do we need to achieve stable factor structure?
- 4) How many hours do we need to describe individual variation?

METHODS

Data were collected on 20 captive cotton-top tamarins (8 ♀, 12 ♂) from 5 different groups. A combination of continuous focal recording (30 minute period) and instantaneous sampling (2 minutes) was used to collect 15 hours of observation per individual. A list of 23 behavioural indices was designed to represent a broad behavioural repertoire of the species. Data were divided into 3 even time blocks to test repeatability with intra-class correlations (Tab 1). A principal component analysis (PCA) of the 23 behavioural indices was used to reveal personality structure. The personality model based on full length of observation (Tab 2) was compared to 14 personality models based on increasing length of time of observation using targeted orthogonal Procrustes rotations (Fig 1). Finally, correlations of individual personality scores based on 5, 10 and 15 hours of observation were computed (Tab 3, Fig 2).

CONCLUSION

- 1) The majority of the 23 behavioural indices was **moderately or highly repeatable** in terms of short-term repeatability.
- 2) PCA based on the full dataset revealed a personality model with **2 components, labelled as Extraversion and Confidence, accounting for 54% of the total variance.**
- 3) The **final model with 2 components can be obtained using only 5 hours of observation, as suggested by congruence coefficients.**
- 4) Individual scores based on 5 hours of observations showed **strong correlations with those obtained after 15 hours. Thus individual variation can be reliably described also after 5 hours of observation.**

DISCUSSION

This is the first study that systematically evaluates the relationship between observational time and personality model development. Our results suggest that behavioural coding is not as time-consuming to assess personality as often claimed. We would like to stress, however, that the minimum of 5 observational hours per individual was collected in the range of 3 to 5 days as the individual was observed at maximum 2 hours per day. These findings are applicable to species with comparable frequencies of behaviours and provided that there is stable social situation in the observed group. Our findings could enrich animal personality research both from practical and theoretical points of view.

RESULTS

Table 1 Repeatability (intra-class correlation coefficients) of the 23 behavioural indices. Repeatability ranged between 0,23 and 0,93 with a mean of 0,60.

ICC (3,1)	Behavioural indices
0,2 - 0,3	Grooming, Invite grooming, Self-grooming, Terminate grooming
0,4 - 0,6	Monitoring, Passive affiliation, Threats, Vigilance
> 0,7	Affiliation Time, Aggression, Approaches, Departures, Diversity of activities, Grimace, Object sniffing, Resting, Scent marking, Scratching, Substrate diversity, Taking food away

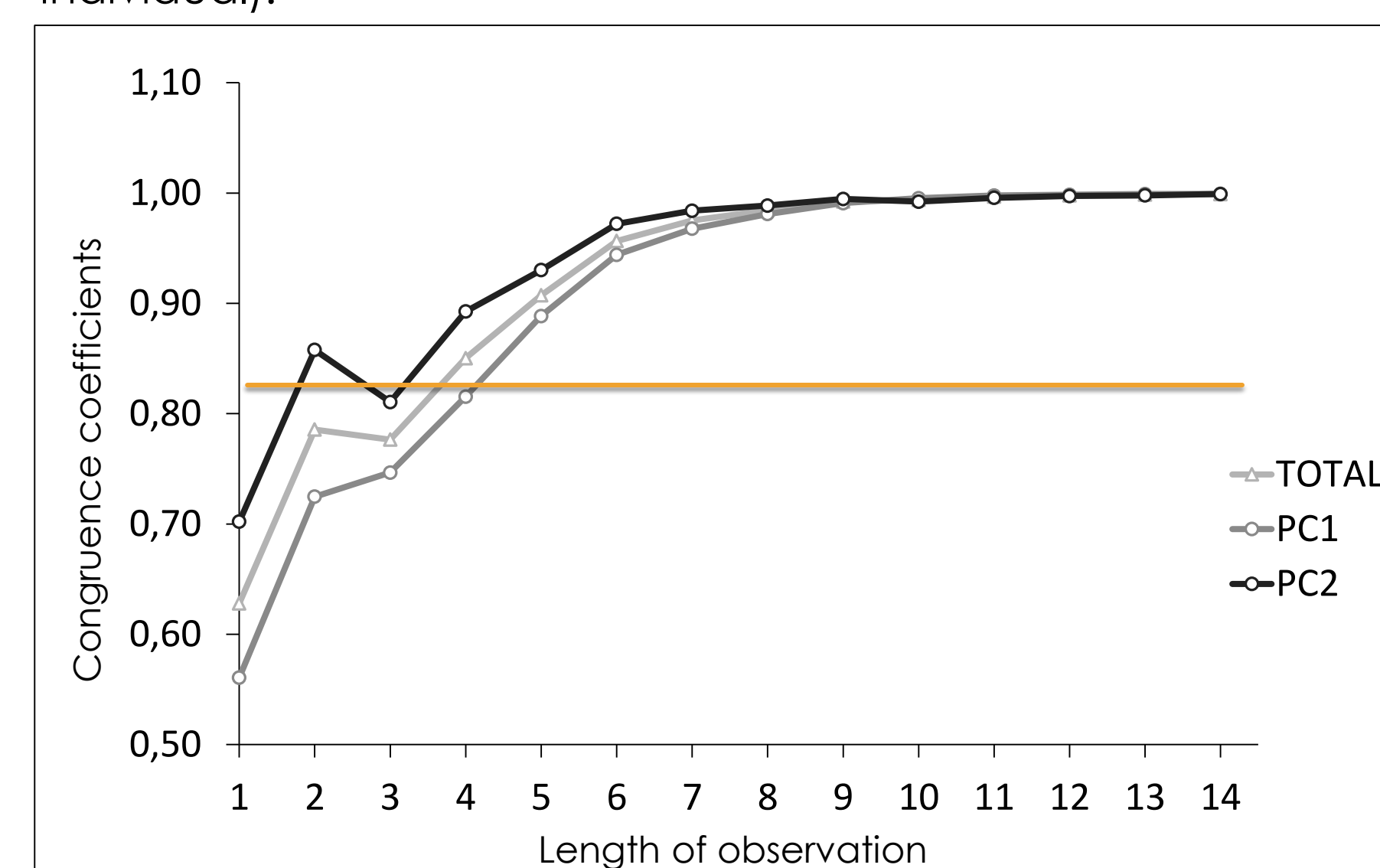
Note. ICC (3,1) was computed using two-way mixed model with the time block as fixed and individual as random factor.

Table 2 Personality model based on full length (15 hours) of observation.

Behavioral index	Extraversion	Confidence	h ²
Diversity of activities ^l	0,89	0,29	0,87
Passive affiliation ^p	-0,88	0,09	0,79
Exploration ^f	0,88	0,00	0,77
Threats(in) ^f	0,88	-0,06	0,77
Vigilance ^f	0,72	-0,42	0,69
Grooming(in) ^f	0,71	0,35	0,62
Invite grooming(rec) ^f	0,68	0,04	0,46
Terminate grooming(in) ^f	0,64	0,41	0,58
Resting ^p	-0,63	-0,44	0,59
Grimace ^f	0,59	-0,12	0,36
Object sniffing ^f	0,49	-0,34	0,36
Monitoring ^l	0,43	-0,09	0,19
Self-grooming ^f	0,40	-0,22	0,21
Departures(in) ^f	-0,17	0,92	0,88
Approaches(in) ^f	-0,07	0,85	0,72
Scratching ^f	-0,12	-0,84	0,72
Affiliation time ^l	-0,25	0,80	0,70
Aggression(in) ^f	-0,05	0,76	0,58
Taking food away(in) ^f	-0,17	0,65	0,45
Grooming(rec) ^f	0,05	0,62	0,38
Substrates diversity ^l	0,30	0,58	0,42
Invite grooming(in) ^f	0,21	0,45	0,25
Explained variability	29%	25%	

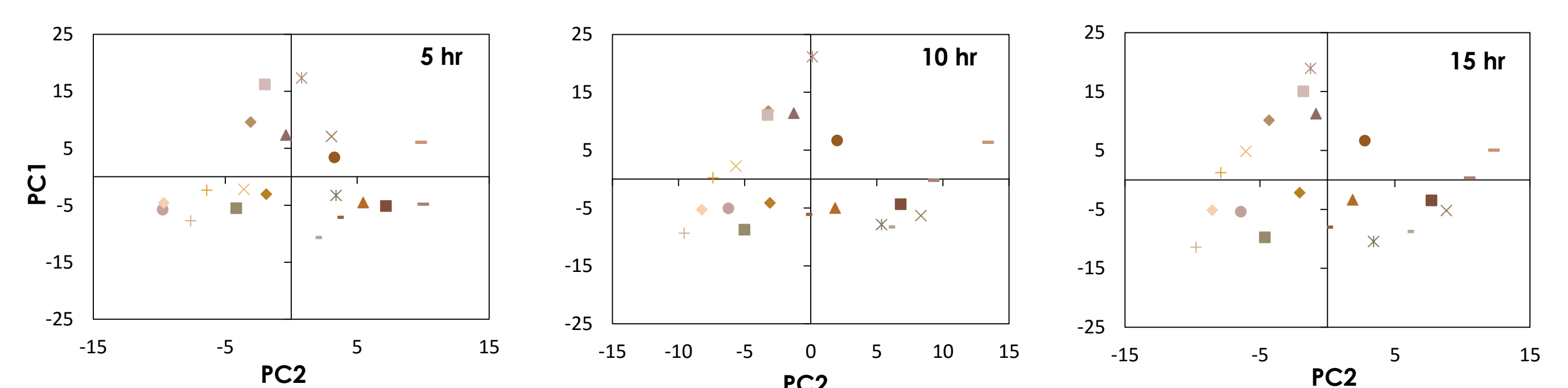
Note. Extraction method: PCA with varimax rotation. Salient loadings are shown in bold. h² = item communalities, ^f = frequencies per hour, ^p = proportions, ^l = time, ^l = Shannon indices, in = initiated, rec = received.

Figure 1 Congruence coefficients calculated by rotating the personality model based on full length of observation (15 hours per individual) toward the personality models derived from different length of observation (1 to 14 hours per individual).



Note. Congruence coefficients <0,85 are not indicative of factor similarity, coefficients from 0,85 to 0,94 are indicative of fair similarity, coefficients ≥0,95 are indicative of equality. Reference line represents the minimal length of observation needed to get correct factor structure.

Figure 2 Visualization of individual personality scores of personality models derived from 5, 10 and 15 hours of observation, respectively.



Note. Each point represents an individual.

Table 3 Pearson correlations of individual personality scores (all p < 0,05).

	PC1	PC2
15 vs. 10	0,98	0,99
15 vs. 5	0,87	0,93
10 vs. 5	0,87	0,92

Note. Scores of each individual based on personality models derived from 5, 10 and 15 hours of observation were compared.

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