Electronic Supplementary Material

**Divergent strategies in faeces avoidance**

**between two cercopithecoid primates**

Cécile Sarabiana, 1, Barthélémy Ngoubangoyeb and Andrew J. J. MacIntosha

*aPrimate Research Institute, Kyoto University, 41-2 Kanrin, Inuyama 484-8506, Japan, CS, 0000-0002-2225-8702*

*bCentre de Primatologie, Centre International de Recherches Médicales de Franceville, Franceville BP 769, Gabon*

1Corresponding author: sarabiancecile@gmail.com

**Supplementary results**

Experiment 1: vision-mediated avoidance of faeces

Mandrills

None of the statistical models with the interaction between substrate and trial outperformed its respective model without the interaction. In condition 1, both models with feeding decision (LRT; ∆LogLik = 5.75, ∆d.f. = 4, p = 0.022; Table S1) and latency to feed (LRT; ∆LogLik = 7.33, ∆d.f. = 4, p = 0.005) as response variables outperformed their respective null models, while both feeding prioritization (LRT; ∆LogLik = 4.15, ∆d.f. = 4, p = 0.081) and olfactory investigation (LRT; ∆LogLik = 0.28, ∆d.f. = 4, p = 0.968) models did not. In condition 2, both feeding decision (LRT; ∆LogLik = 7.66, ∆d.f. = 5, p = 0.009; Table S1) and olfactory investigation (LRT; ∆LogLik = 7.27, ∆d.f. = 5, p = 0.012) models outperformed their respective nulls while feeding prioritization (LRT; ∆LogLik = 0.56, ∆d.f. = 5, p = 0.953) and latency to feed (LRT; ∆LogLik = 4.53, ∆d.f. = 5, p = 0.107) models did not.

Macaques

First, none of the statistical models including the interaction between substrate and trial outperformed their respective model without the interaction. Four models without the interaction significantly outperformed their respective null models in condition 1 (‘feed’: LRT; ∆LogLik = 6.08, ∆d.f. = 3, p = 0.007; ‘latency to feed’: LRT; ∆LogLik = 4.38, ∆d.f. = 3, p = 0.033; ‘smell’: LRT; ∆LogLik = 14.85, ∆d.f. = 3, p = 1.6e-6; ‘manipulate’: LRT; ∆LogLik = 4.69, ∆d.f. = 3, p = 0.025; Table S1), so we explored the model parameters further, while the feeding prioritization model did not (LRT; ∆LogLik = 0.96, ∆d.f. = 3, p = 0.591). In condition 2, none of the full models without the interaction outperformed their respective null models (Table S1).

Experiment 2: olfaction-mediated avoidance of faeces

Mandrills

As before, the addition of interaction terms between odor and trial did not outperform models without them. Both feeding decision (LRT; ∆LogLik = 12.58, ∆d.f. = 4, p = 4.7e-5) and olfactory investigation (LRT; ∆LogLik = 6.28, ∆d.f. = 4, p = 0.014) models without the interaction outperformed their respective null models while the feeding latency model did not (LRT; ∆LogLik = 3.39, ∆d.f. = 4, p = 0.148; Table S1).

Macaques

As in experiment 1, none of the full models with the interaction between odor and trial outperformed models without it. While the feeding latency (LRT; ∆LogLik = 9.53, ∆d.f. = 3, p = 2.1e-4) and olfactory investigation (LRT; ∆LogLik = 9.54, ∆d.f. = 3, p = 2.6e-4) models without the interaction outperformed their respective null models, both the consumption (LRT; ∆LogLik = 1.86, ∆d.f. = 3, p = 0.293) and manipulation (n/a) models did not (Table S1).

**Table S1.** Likelihood ratio tests comparing fitted versus null models used in mandrills (c1: experiment 1 condition 1; c2: experiment 1 condition 2). Bold text denotes cases in which the fitted models significantly outperformed their respective null models. Significant effects are marked: \*\*\*(p < 0.001), \*\*(p < 0.01), \*(p < 0.05).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Statistical Model [X] | ΔLogLik | Δdf | *X*2 | P|>*X*2| |
| [1] vision-mediated avoidance of faeces (c1)/feed | **5.75** | **4** | **11.49** | **0.022\*** |
| [2] vision-mediated avoidance of faeces (c1)/feed first | 4.15 | 4 | 8.31 | 0.081 |
| [3] vision-mediated avoidance of faeces (c1)/feed latency | **7.33** | **4** | **14.65** | **0.005\*\*** |
| [4] vision-mediated avoidance of faeces (c1)/smell | 0.28 | 4 | 0.55 | 0.968 |
| [5] vision-mediated avoidance of faeces (c2)/feed | **7.66** | **5** | **15.32** | **0.009\*\*** |
| [6] vision-mediated avoidance of faeces (c2)/feed first | 0.56 | 5 | 1.12 | 0.953 |
| [7] vision-mediated avoidance of faeces (c2)/feed latency | 4.53 | 5 | 9.07 | 0.107 |
| [8] vision-mediated avoidance of faeces (c2)/smell | **7.27** | **5** | **14.55** | **0.012\*** |
| [9] olfaction-mediated avoidance of faeces/feed | **12.58** | **4** | **25.15** | **4.7e-5\*\*\*** |
| [10] olfaction-mediated avoidance of faeces/feed latency | 3.39 | 4 | 6.78 | 0.148 |
| [11] olfaction-mediated avoidance of faeces/smell | **6.28** | **4** | **12.56** | **0.014\*** |

**Table S2.** Likelihood ratio tests comparing fitted versus null models used in long-tailed macaques (c1: experiment 1 condition 1; c2: experiment 1 condition 2). Bold text denotes cases in which the fitted models significantly outperformed their respective null models. Significant effects are marked: \*\*\*(p < 0.001), \*\*(p < 0.01), \*(p < 0.05). Note that models [9] and [14] could not be performed due to convergence issues (i.e. small sample size of the data).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Statistical Model [X] | ΔLogLik | Δdf | *X*2 | P|>*X*2| |
| [1] vision-mediated avoidance of faeces (c1)/feed | **6.08** | **3** | **12.16** | **0.007\*\*** |
| [2] vision-mediated avoidance of faeces (c1)/feed first | 0.96 | 3 | 1.91 | 0.591 |
| [3] vision-mediated avoidance of faeces (c1)/feed latency | **4.38** | **3** | **8.76** | **0.033\*** |
| [4] vision-mediated avoidance of faeces (c1)/smell | **14.85** | **3** | **29.71** | **1.6e-6\*\*\*** |
| [5] vision-mediated avoidance of faeces (c1)/manipulate | **4.69** | **3** | **9.37** | **0.025\*** |
| [6] vision-mediated avoidance of faeces (c2)/feed | 3.58 | 4 | 7.16 | 0.128 |
| [7] vision-mediated avoidance of faeces (c2)/feed first | 1.26 | 4 | 2.51 | 0.643 |
| [8] vision-mediated avoidance of faeces (c2)/feed latency | 4.04 | 4 | 7.90 | 0.095 |
| [9] vision-mediated avoidance of faeces (c2)/smell | n/a | n/a | n/a | n/a |
| [10] vision-mediated avoidance of faeces (c2)/manipulate | 3.70 | 4 | 7.40 | 0.116 |
| [11] olfaction-mediated avoidance of faeces/feed | 1.86 | 3 | 3.72 | 0.293 |
| [12] olfaction-mediated avoidance of faeces/feed latency | **9.53** | **3** | **19.57** | **2.1e-4\*\*\*** |
| [13] olfaction-mediated avoidance of faeces/smell | **9.54** | **3** | **19.07** | **2.6e-4\*\*\*** |
| [14] olfaction-mediated avoidance of faeces/manipulate | n/a | n/a | n/a | n/a |

**Table S3.** Participating subject details for mandrills and long-tailed macaques. Sex is given as m for males and f for females, age is given in the number of years at the time of the study, and dominance rank is based on social interactions recorded by the staff during the study period. Vision and Olfaction reflect the two sensory modalities for which subjects could be tested (indicated as “1” and “2” for the two conditions of Exp. 1, “x” for Exp. 2 or blank if not tested). Note that for long-tailed macaques exact age is unknown but all arrived in 2003 with already a few years of age, and that the dominance rank of mandrills is unknown.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Subject | Species | Sex | Age | Dominance rank | Group | Vision | Olfaction |
| Cali | LTM | m | >14 | low | V6G3 | 1, 2 | x |
| Chris | LTM | m | >14 | high | V6G2 | 1, 2 | x |
| Crouw | LTM | m | >14 | high | V6D2 | 1, 2 | x |
| Deniro | LTM | m | >14 | low | V6D3 | 1, 2 | x |
| Diego | LTM | m | >14 | low | V6D2 | 1, 2 | x |
| Johny | LTM | m | >14 | low | V6D3 | 1 | x |
| Jojo | LTM | m | >14 | low | V6G3 | 1, 2 | x |
| Lou | LTM | m | >14 | high | V6D1 | 1, 2 | x |
| Luigy | LTM | m | >14 | low | V6D1 | 1, 2 | x |
| Many | LTM | m | >14 | high | V6G1 | 1, 2 | x |
| Mike | LTM | m | >14 | low | V6G2 | 1, 2 | x |
| Muipo | LTM | m | >14 | low | V6G2 | 1, 2 | x |
| Narko | LTM | m | >14 | low | V6G1 | 1, 2 | x |
| Ogooue | LTM | m | >14 | low | V6D1 | 1, 2 | x |
| Po | LTM | m | >14 | low | V6D2 | 1, 2 | x |
| Psycho | LTM | m | >14 | low | V6G1 | 1, 2 | x |
| Queuecourte | LTM | m | >14 | low | V6D3 | 1, 2 | x |
| Raphy | LTM | m | >14 | low | V6G2 | 1, 2 | x |
| Tchac | LTM | m | >14 | low | V6D3 | 1, 2 | x |
| Tof | LTM | m | >14 | low | V6D2 | 1, 2 | x |
| 2D4 | M | f | 20 | - | E2 | 1, 2 | x |
| 2D14 | M | m | 8 | - | E2 | 1, 2 | x |
| 6H | M | f | 13 | - | E2 | 1, 2 | x |
| 16B | M | m | 27 | - | E2 | 1, 2 | x |
| 16G2 | M | f | 12 | - | E2 | 1, 2 | x |
| 16I | M | m | 16 | - | E2 | 1, 2 | x |
| 17A6 | M | m | 17 | - | E2 | 1, 2 | x |
| 17A10 | M | m | 11 | - | E2 | 1, 2 | x |
| 17B6 | M | f | 17 | - | E2 | 1, 2 | x |
| 17B7B | M | m | 6 | - | E2 | 1, 2 | x |
| 17B8A | M | m | 8 | - | E2 | 1, 2 | x |
| 17B11 | M | m | 11 | - | E2 | 1, 2 | x |
| 17F3 | M | m | 13 | - | E2 | 1, 2 | x |
| 30 | M | m | 13 | - | E1 | 1, 2 | x |
| 33A | M | m | 8 | - | E1 | 1, 2 | x |
| NB | M | f | 13 | - | E1 | 1, 2 | x |
| PC | M | f | 11 | - | E1 | 1, 2 | x |
| PM | M | m | 5 | - | E2 | 1, 2 | x |
| 45 | M | f | 6 | - | E1 | 1 | x |
| 42 | M | f | 8 | - | E1 | 1 | x |
| 10N1 | M | f | 10 | - | E1 | 1 | x |
| PB2 | M | f | 8 | - | E1 | 1 | x |
| 17D2A2 | M | m | 5 | - | E2 | 1 | x |
| U2A2 | M | m | 10 | - | E1 |  | x |