

Evolution of Investment in Immatures in Adult Male Japanese Macaques

(*Macaca fuscata*)



Noa Cohen¹, Kylan N. Gartland^{1,2}, and Frances J. White¹

¹Department of Anthropology, University of Oregon, Eugene, Oregon

^{1,2}Detroit Zoological Society, Detroit, Michigan



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1. Background

Investment in immatures by adult males is uncommon in non-human primates. Investment behaviors may vary along a spectrum from costly infant-carrying in callitrichids to occasional low-cost grooming in cercopithecines. In relatively infrequent situations where care is directed towards non-kin juveniles, these behaviors have been examined within the context of the mating effort hypothesis (MEH) or the alliance formation hypothesis (AFH). The MEH proposes that adult males direct care towards immatures to influence female mate choice (Smuts & Gubernick, 1992). The AFH proposes that males direct affiliation towards immatures in order to establish potential future coalitionary alliances (Watanabe, 1979). Juvenile-directed affiliation by adult males has been repeatedly observed in Japanese macaques (*Macaca fuscata*) (Gartland, 2021). However, the variables which influence degree and recipient choice of juvenile-directed affiliation are unknown. In this study, we examined sex-based preferences in juvenile-directed affiliation by adult male semi-free ranging Japanese macaques.

2. Objectives of the Study

- Determine the rate at which adult males direct affiliation towards juvenile males *versus* juvenile females
- Assess whether adult males demonstrate a juvenile sex preference when engaging in juvenile directed positive affiliation.

3. Subjects

Subjects of this study were 17 adult male Japanese macaques in a semi-free ranging group at the Oregon National Primate Research Center (ONPRC). These males varied in age from 7 to 25 years. Individuals were independently identifiable by dye markings on their backs

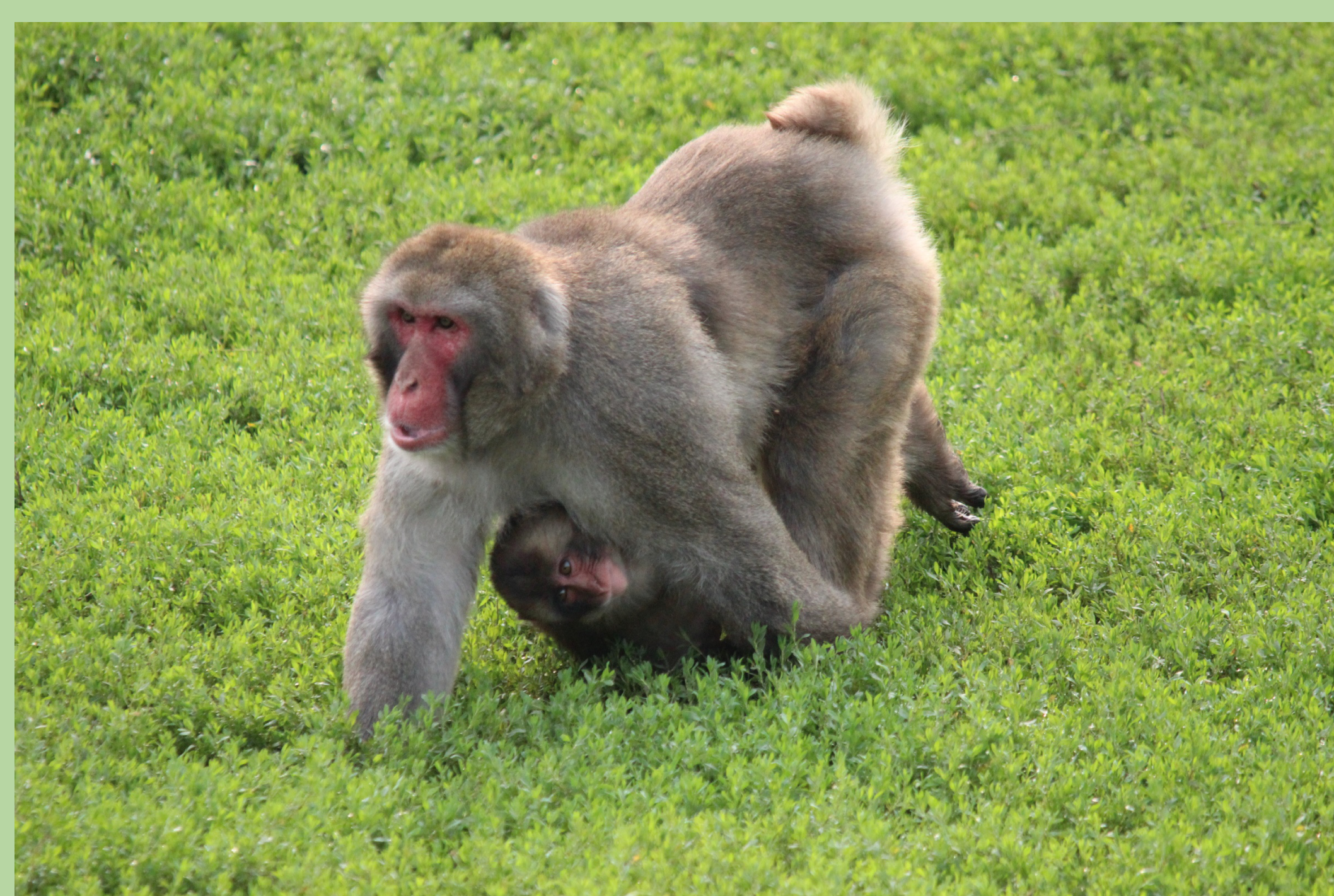


Figure 1: Adult male Japanese macaque ventral-carrying a juvenile. Photo by Dr. Kylan Gartland

4. Data Collection and Analysis

We collected a total of 512.5 hours of behavioral data using 15-minute focal follows with one-minute instantaneous scans. Data collection spanned two distinct study periods: 1) June – September 2018 and 2) July – December 2019.

We examined the sociality data and identified 8 of the 17 study males which were observed directing affiliation towards a juvenile. For these 8 males, we calculated the rate of affiliation directed towards male juveniles and the rate of affiliation directed towards female juveniles. We then ran a replicated goodness of fit test with a Williams correction on the observed frequency of adult male interactions with juvenile males and juvenile females.

Table 1. Pooled distribution results.

Test	G	df	P
G(Williams)	12.153	1	0.0005
Heterogeneity G	36.920	7	<0.0001
Total G	49.141	8	<0.0001



Table 2. Goodness of fit results.

Male	Estimates				Test Statistics		
	Male	M_Exp	Female	F_Exp	G	df	P
1	6	17.3	30	18.7	15.49	1	<0.0001
2	3	7.2	12	7.8	4.96	1	0.03
3	3	1.4	0	1.6	3.76	1	0.05
4	2	4.3	7	4.7	2.44	1	0.12
5	9	6.3	4	6.7	2.28	1	0.13
6	0	1.4	3	1.6	3.37	1	0.07
7	0	3.4	7	3.6	8.57	1	0.003
8	4	1.9	0	2.1	5.20	1	0.02

5. Results

- Males 4, 5, and 6 fit the expected sex ratio and therefore do not demonstrate juvenile sex preference (Table 2).
- Males 1, 2, and 7 demonstrate female juvenile preference while males 3, and 8 demonstrate male juvenile preference (Table 2).
- There is significant heterogeneity, indicating that adult males differ from one another (Table 1).

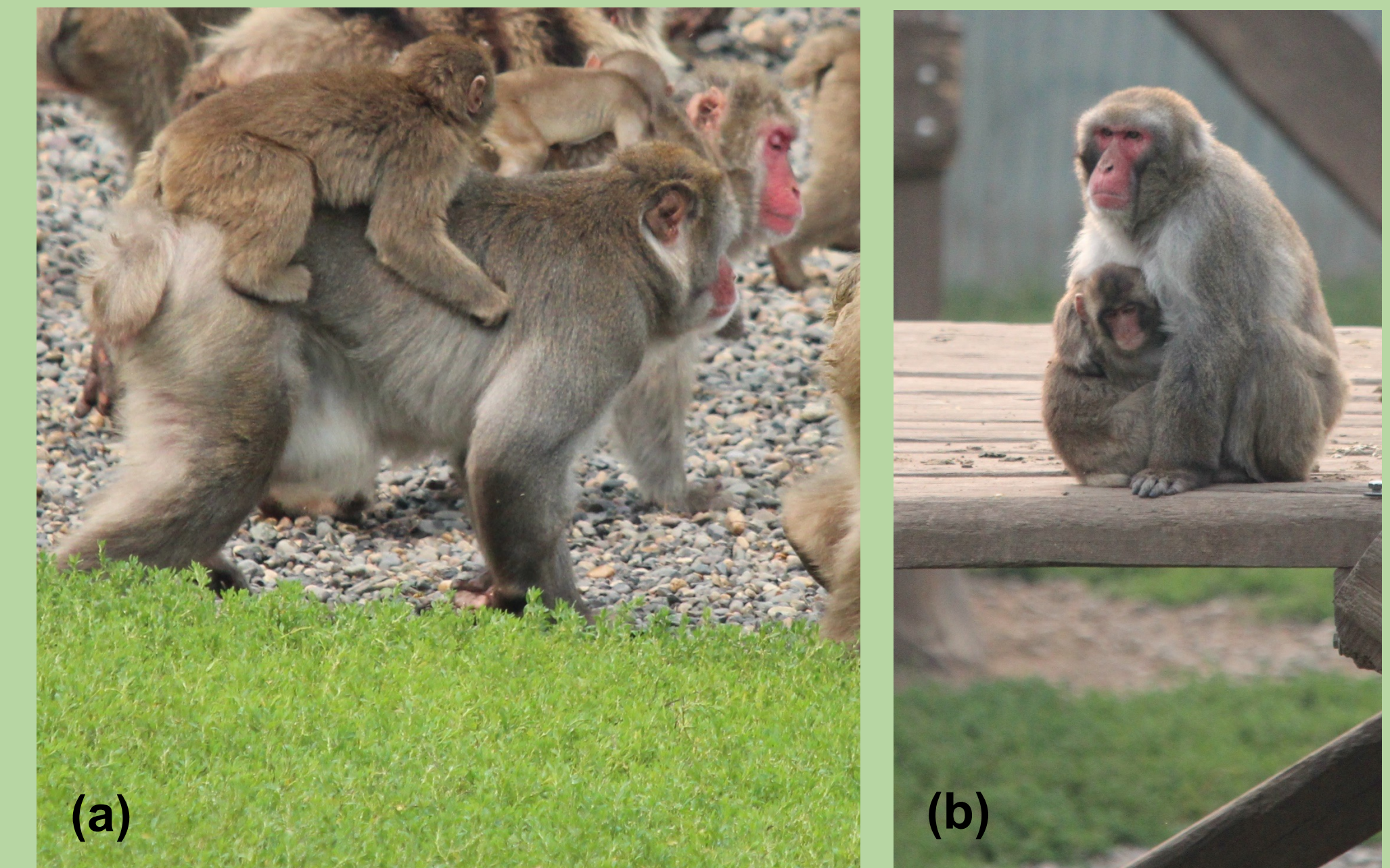


Figure 2: Adult male Japanese macaque (a) dorsal-carrying a juvenile and (b) ventral-huddling with a juvenile. Photos by Kylan Gartland

6. Discussion & Implications

Of the 8 adult males which demonstrated juvenile-directed affiliation, 5 of these males showed sex-based preference in their juvenile social partner. These results in addition to the observed significant heterogeneity among the males indicates that the sex of the juvenile is a determining factor in male directed affiliation.

Sex-based preference may serve multiple evolutionary purposes. Adult male preference towards male juveniles may be a form of early alliance formation. Other variables such as adult male rank and age of the male may contribute to alliance formation efforts. The MEH may explain adult male preference toward female juveniles. Males demonstrate increased mating effort in polygynandrous systems where females choice can influence reproductive success. Males may preferentially affiliate with female juveniles either as a means of influencing adult females within the juvenile's matriline or as a means of courting favor before the female reaches sexual maturity.

These results offer preliminary insight into the factors guiding male juvenile-directed affiliation. However, future studies should examine further influencing variables such as male rank, age, and reproductive success as a means of testing whether sex-based preference conforms to either the AFH or MEH.

Acknowledgments

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