

# The length of the 2nd to 4th digit ratio (2D:4D) and its relationship to primate mating systems and human social evolution: some preliminary results

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## Introduction

There is evidence in humans that the length ratio of the 2<sup>nd</sup> and 4<sup>th</sup> digits (2D:4D) is negatively correlated with prenatal testosterone (PT)<sup>1,2</sup> and higher genetic sensitivity to androgens<sup>3</sup>. The androgen receptor gene (AR) contains a polymorphic trinucleotide repeat region that codes for a polyglutamine chain (Gln). When Gln is low, transactivation of the AR is high and is associated with higher sensitivity to androgens. Both low Gln and high PT (low 2D:4D) have been correlated with higher male fertility<sup>4,5</sup> and low 2D:4D has also been associated with more successful male-male competitive behaviours<sup>6</sup>. PT and the AR are both known to vary between human populations<sup>7,8</sup> and marriage systems may also influence mean 2D:4D such that polygynous societies show high PT (low 2D:4D) while monogamous groups show low PT (high 2D:4D)<sup>7,9</sup> (Fig. 1).

Here we ask whether similar patterns of mean 2D:4D are evident in the mating systems of non-human primates.

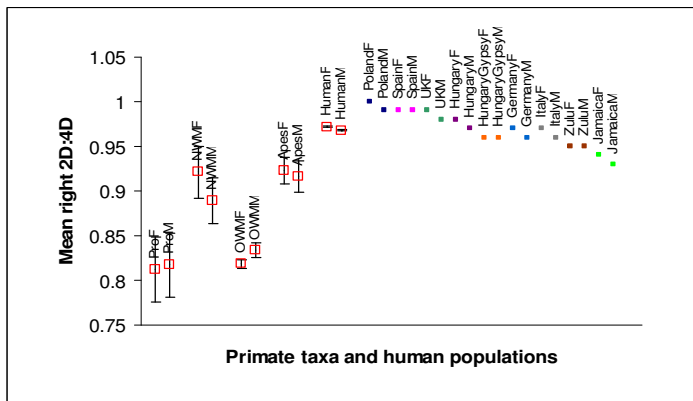


Figure 1. Mean right 2D:4D (length of 2nd digit / length of 4th digit) of 9 human populations<sup>7</sup> and primate taxa (F=female and M=male). Bars show standard errors.

## Materials and Methods

45 zoos and primate facilities agreed to obtain lengths of the 2<sup>nd</sup> and the 4<sup>th</sup> digits from both hands while the animals were anaesthetised for another procedure. 283 individuals (103 males) from 38 species were measured. Measurement procedure followed that used for humans; lengths taken along the midline of the digit from the proximal crease at the to the fingertip. The digit was held extended throughout and care was taken not to compress the fingertip (Fig. 2). 2D:4D from 178 left hands and 265 right hands were obtained and all measurements were to the nearest millimetre. For the preliminary analysis the anthropoid species were assigned to a mating system using the categories of inter-male competition outlined in Plavcan and Van Schaik, 1992 (Fig. 3). Possible effects of phylogenetic inertia were not considered in this analysis.



Figure 2. Digit length measurements.

## References

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Category	Inter-male competition type
1	Low intensity and low frequency of mating, e.g. monogamous and polyandrous species.
2	Low frequency, low intensity multi-male/multi-female social systems with relatively tolerant male dominance hierarchies.
3	Low frequency, high intensity inter-male competition. Most species classed as single male/multi-female fall into this group.
4	High frequency, high intensity inter-male competition. Most species in this group have multi-male/multi female social systems in which the males maintain an agnostic hierarchy year-round.

Figure 3. Anthropoid mating categories based upon intensity of inter-male competition<sup>10</sup>. For the preliminary analysis each species was assigned to a category according to the species list presented in Plavcan and Van Schaik (1992).

## Results

Mean 2D:4D was 0.839+/-0.072 for the right hand and 0.840+/-0.074 for the left, lower than typical human mean 2D:4D (0.98 to 1.00). Two-factor ANOVA with factors for sex (male, female) and taxon (Apes, Old World Monkeys (OWM), New World Monkeys, Prosimians) with dependent variable right 2D:4D showed a significant main effect for taxon ( $F=20.80$ ,  $p=0.0001$ ) and non-significant effects for the interaction and sex. Apes had the highest mean 2D:4D ( $M=0.915$ ; Fig.1). We excluded Prosimians and performed a two-factor ANOVA (sex [male, female]) and mating system<sup>10</sup> (Fig. 3) with dependent variable right 2D:4D. There was a significant main effect for mating system ( $F=9.19$ ,  $p=0.0001$ ) with a reduction in mean 2D:4D with increasing competition for mates (1=0.913, 2=0.90, 3=0.84, 4=0.827; Fig.4). There were no significant sex or interaction effects.

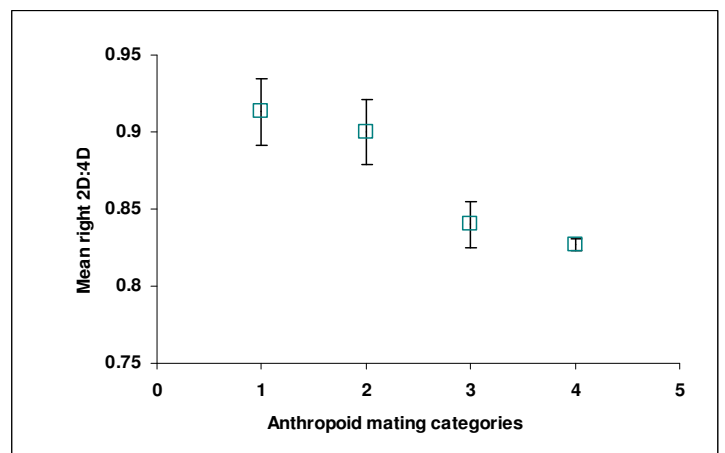


Figure 4. Right mean 2D:4D (males and females; n=251) according to anthropoid mating categories<sup>10</sup> (see above). 2D:4D reduces (PT increases) with increasing competition for mates.

## Conclusions

We tentatively suggest that, on the evidence of 2D:4D, non-human primates have higher PT (lower 2D:4D) than humans, PT varies between taxa with the lowest PT (higher 2D:4D) found among Apes, and PT reduces with reducing sexual selection such that the lowest PT (highest 2D:4D) is found in mating systems with low intensity/low frequency mating.

PT and the transactivational effects of the AR both appear to diminish through the Primate Order, with humans being the least effected by the early organisational properties of testosterone<sup>3,11,12</sup>. In humans, and possible African apes, phenotypic expression of PT and the AR may be perceived as signals of male quality. Selection pressure on these variables seems likely to differ according to intensity of sexual selection. This hypothesis is currently being explored<sup>13</sup> and may inform us about the evolution of human mating systems and sociality.

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