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# **Chimpanzee lip-smacking facilitates cooperative behaviour**

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20 SUPPLEMENTARY INFORMATIONS

21 SUPPLEMENTARY METHODS

22 Male preferred social partners

23 PSPs were established on the basis of three different dyadic association measures. The first  
24 measure, Simple Ratio Index (SRI), reflects the total proportion of scans in which both  
25 individuals were together in the same party<sup>1</sup>, or:

$$SRI_{AB} = \frac{P_{AB}}{P_A + P_B - P_{AB}}$$

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27 Where  $P_{AB}$  = the number of parties containing both A and B,  $P_A$  = the number of parties  
28 containing A,  $P_B$  = the number of parties containing B.

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30 The second dyadic association measure is the ‘5 metre association index’ (5M)<sup>2</sup> which  
31 measures the frequency with which a dyad was observed within 5m of one another, given  
32 that one of the individuals was present in the party and another one was a focal:

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$$5M_{AB} = \frac{A_f(B_5) + B_f(A_5)}{A_f(B_p) + B_f(A_p)}$$

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35 Where  $A_f(B_5)$  = the number of instances in which A was the focal animal and B was within  
36 5m of A,  $B_f(A_5)$  = the number of instances in which B was the focal animal and A was within  
37 5m,  $A_f(B_p)$  = the number of instances A was the focal and B was in the same party,  $B_f(A_p)$  = B  
38 was the focal and A was in the same party.

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40 The third employed dyadic association measure is the ‘nearest neighbour association index’  
41 (NN)<sup>2</sup>, which reflects the frequency with which two individuals were observed as nearest  
42 neighbours, provided that one was the focal and the other was within 5m, or:

$$NN_{AB} = \frac{A_f(B_{nn}) + B_f(A_{nn})}{A_f(B_5) + B_f(A_5)}$$

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44 Where  $A_f(B_{nn})$ = the number of instances A was the focal and B was the nearest neighbour  
45 and  $B_f(A_{nn})$ = the number of instances B was the focal and A was the nearest neighbour.

46 To calculate PSPs for each focal chimpanzee, we first examined each index (SRI, 5N and  
47 NN) to identify any individuals for whom the index value was ½ standard deviation larger  
48 than the focal animal’s average (labelled as “associate”). In order to be classified as a PSP,  
49 individuals had to be categorised as an associate on at least two of the three indexes<sup>2</sup>. Since  
50 association dynamics in chimpanzees change on a temporal basis (e.g.,<sup>3</sup>), we conducted  
51 association calculations for three separate periods with durations between four and five  
52 months: between June and October 2013, February and May 2014, and between June and  
53 September 2014. For the first, second and third study period we identified 28, 34 and 30  
54 preferred social partners across the focal male chimpanzees, respectively. All remaining  
55 possible social partners for each focal were labelled as neutral social partners (non-PSPs). It  
56 is important to note that we calculated unidirectional rather than mutual PSPs, therefore,  
57 within a dyad A might be a preferred social partner for B, B however might not be a preferred  
58 social partner for A.

59

60 Dominance status

61 Dominance status was established only for adult and late adolescent males, using the Elo-  
62 rating procedure. This method is based on a sequence in which interactions between  
63 individuals occur rather than on an interaction matrix <sup>4</sup>. At the onset of the process each  
64 individual is given the same rating of a value 1000. After each agonistic or submissive  
65 interaction the score is updated with the winner of the interaction gaining whereas the loser  
66 losing points <sup>4</sup>. The number of points gained or lost by two interacting individuals is  
67 dependent on the expected outcome which in turn depends on previous interactions between  
68 these two individuals <sup>5</sup>. The scores were based on interactions such as pant grunts (i.e.,  
69 vocalisations given by males to other males that outrank them) combined with the outcomes  
70 of dyadic win-lose agonistic interactions (i.e. physical attack, chase, charge, displacements,  
71 etc. <sup>6-8</sup>) recorded during the study period and, for the purpose of analyses, calculated for each  
72 day of data collection. The Elo-rating method has several advantages over more traditional  
73 methods such as sensitivity to short-term demography changes, effectiveness in tracking  
74 hierarchy dynamics on short-term scales, and more effective evaluation of relative hierarchy  
75 position between individuals with undecided interactions <sup>4</sup>. We believe that this method was  
76 especially effective in establishing dominance positions of the Sonso males, since the  
77 hierarchy was unstable throughout the study period with no clear alpha male after one of the  
78 males had lost his alpha status prior to the study period. Elo-rating scores were calculated  
79 using R v.3.1.1 (The R Foundation for Statistical Computing, Vienna, Austria, [http://www.r-](http://www.r-project.org)  
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