**Supplementary Materials**

**Table S1** Results from Mantel tests comparing network structure across four study years for the Sonso and Waibira chimpanzee communities

| Community | Years | Z | P-value |
|---|---|---|---|
| Sonso | 2015-2016 | 7.316 | 0.002 |
| Sonso | 2015-2017 | 6.475 | < 0.001 |
| Sonso | 2015-2018 | 6.953 | < 0.001 |
| Sonso | 2016-2017 | 6.754 | 0.002 |
| Sonso | 2016-2018 | 7.27 | 0.003 |
| Sonso | 2017-2018 | 6.465 | < 0.001 |
| Waibira | 2015-2016 | 10.215 | < 0.001 |
| Waibira | 2015-2017 | 5.842 | < 0.001 |
| Waibira | 2015-2018 | 6.535 | < 0.001 |
| Waibira | 2016-2017 | 7.397 | < 0.001 |
| Waibira | 2016-2018 | 8.792 | < 0.001 |
| Waibira | 2017-2018 | 5.087 | < 0.001 |

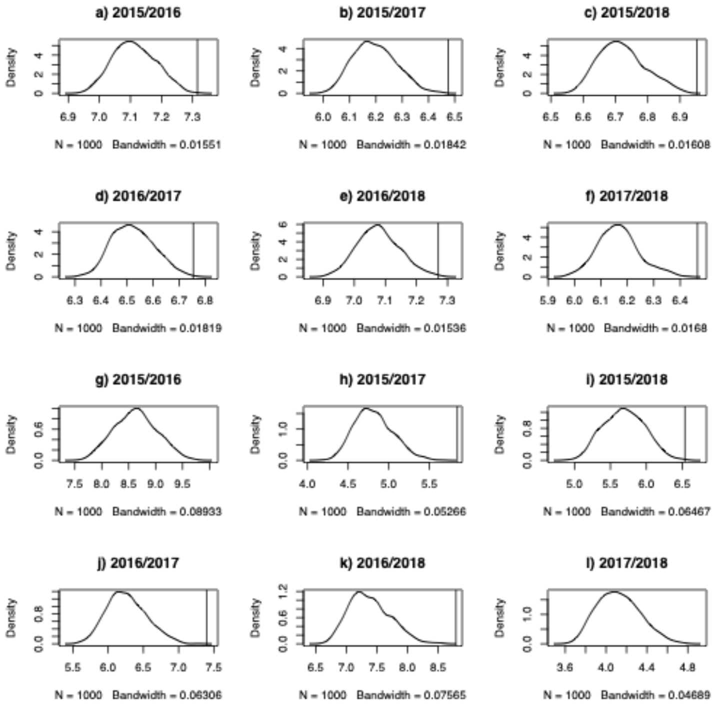


**Fig. S1** Results of Mantel test between four years of the study period. Plots a-f represent yearly comparisons of the Sonso community and plots g-l represent the results from the Waibira community

**Table S2** Network measure results from subset randomisation method used for analyses. P values indicate if observed measure was greater or smaller than expected from null models generated from 10 000 permutations of subsetted dataset.

| Network measure (community) | Observed value | P(greater) | P(smaller) |
|---|---|---|---|
| Transitivity (Sonso) | 1 | 1 | 1 |
| Transitivity (Waibira) | 1 | 1 | 1 |
| Mean Strength (Sonso) | 3.54 | <0.001 | 0.999 |
| Mean Strength (Waibira) | 3.736 | 0.498 | 0.5021 |
| Modularity (Sonso) (Optimal clustering) | $-1.798^{-16}$ | 0.789 | 0.212 |
| Modularity (Waibira) (Optimal clustering) | 0.016 | <0.001 | 1 |
| Modularity (Sonso) (Louvain's clustering) | 0 | 0.6 | 0.584 |
| Modularity (Waibira) (Louvain's clustering) | 0.016 | <0.001 | 1 |

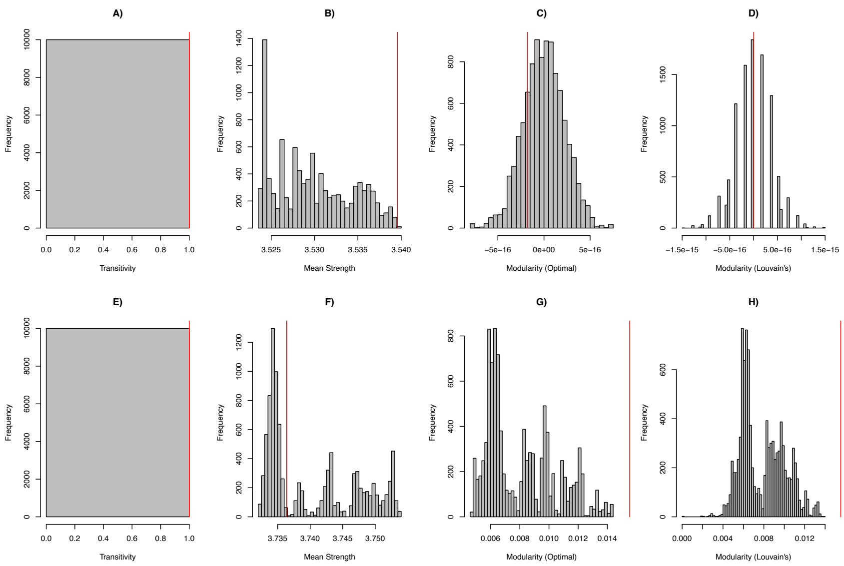


**Fig. S2**

Histogram distribution of a) Sonso Transitivity, b) Sonso mean Strength, c) Sonso Modularity, based on optimal clustering algorithm from igraph, d) Sonso Modularity, based on Louvain's clustering algorithm e) Waibira Transitivity, f) Waibira mean Strength and g) Waibira Modularity, based on optimal clustering algorithm from igraph, h) Waibira Modularity, based on Louvain's clustering algorithm measures from 10,000 data stream permutations of each social networks using subset randomisation method. Red lines indicate measures from networks created from original party composition data

**Table S3:** D dissimilarity values between communities and between Sonso and Waibira clusters using subset data. G is the community/cluster to be compare with G' (another community/cluster).

| **G** | **G'** | **D(G, G')** |
|---|---|---|
| Sonso (Full) | Waibira (Full) | 0.09632188 |
| Sonso (Full) | Waibira_A | 0.05519558 |
| Sonso (Full) | Waibira_B | 0.2014582 |

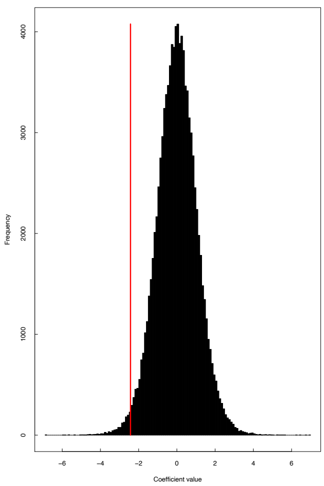


**Fig. S3**

Illustration distribution of model coefficients from the double permutations of null model testing the relationship between individual Strength and cluster membership in the Waibira community; the red line indicates the coefficient from the model testing the original data.

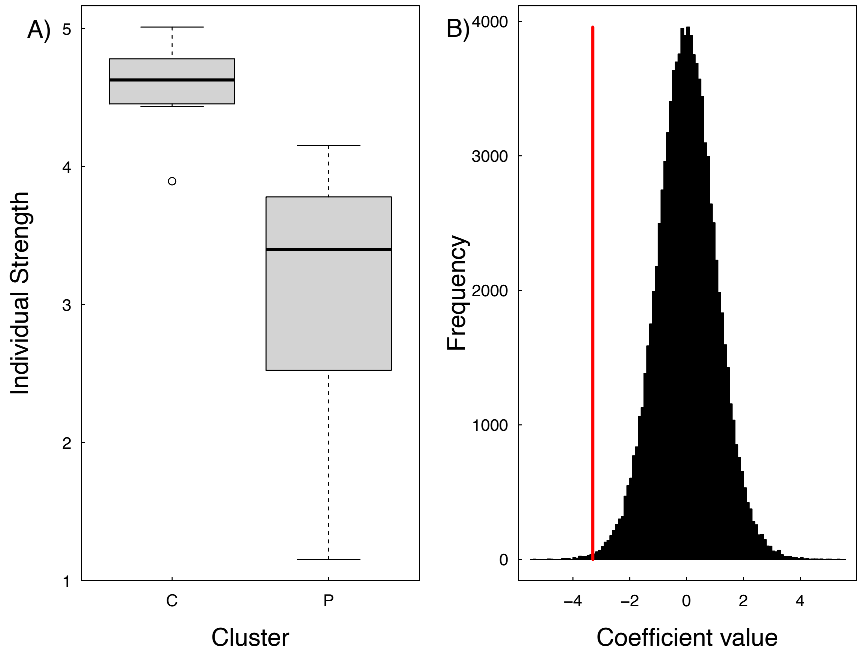


**Fig. S4**

Illustration linear model results from subset randomisation (F = 10.89, DF = 1, adjusted $R^2$ = 0.32, p-value = 0.0019). A) Boxplot illustration of the range of individual Strength in each group with thick lines illustrating the mean Strength in the community, box limits are the lower (25%) and upper (75%) confidence intervals, and the range shows the most extreme (highest/lowest) Strengths that are no more than the range multiplied by the interquartile range, and B) distribution coefficients from the double permutations of null model testing the relationship between individual Strength and cluster membership in the Waibira community; the red line indicates the coefficient from the model testing the original data.

**Table S4 Levenshtein Distance between Waibira core clusters across each pair of consecutive study years in Waibira subset**

*All comparisons are made for the core cluster identified across the four-year study period. The core was defined as the cluster with the highest probability of connections. In this table we report the Levenshtein Distance between two core clusters of consecutive years and the number of individuals in the core for each year in parentheses. E.g. between the first two study years the Levenshtein distance between the cores was 1 and the cluster size for both years was 10 individuals, we report this as 1 (10, 10)*

| **Years** | **Levenshtein Distance** |
|---|---|
| 2015/2016 – 2016/2017 | 3 (12, 10) |
| 2016/2017 – 2017/2018 | 10 (10, 14) |
| 2017/2018 – 2018/2019 | 9 (14, 11) |

**Table S5** Network measure results from individual randomisation method used for analyses. P values indicate if the observed measure was greater or smaller than expected from null models generated from 10,000 permutations of adult only dataset.

| Network measure (community) | Observed value | P(greater) | P(smaller) |
|---|---|---|---|
| Transitivity (Sonso) | 1 | 1 | 1 |
| Transitivity (Waibira) | 1 | 1 | 1 |
| Mean Strength (Sonso) | 2.391082 | 0.0056 | 0.9957 |
| Mean Strength (Waibira) | 2.387714 | 0.8531 | 0.1472 |
| Modularity (Sonso) (Optimal) | 5.306^-17 | 0.43 | 0.572 |
| Modularity (Waibira) (Optimal) | 0.018 | <0.001 | 1 |
| Modularity (Sonso) (Louvain’s) | -2.122597e-16 | 0.723 | 0.66 |
| Modularity (Waibira) (Louvain’s) | 0.01753887 | <0.001 | 1 |

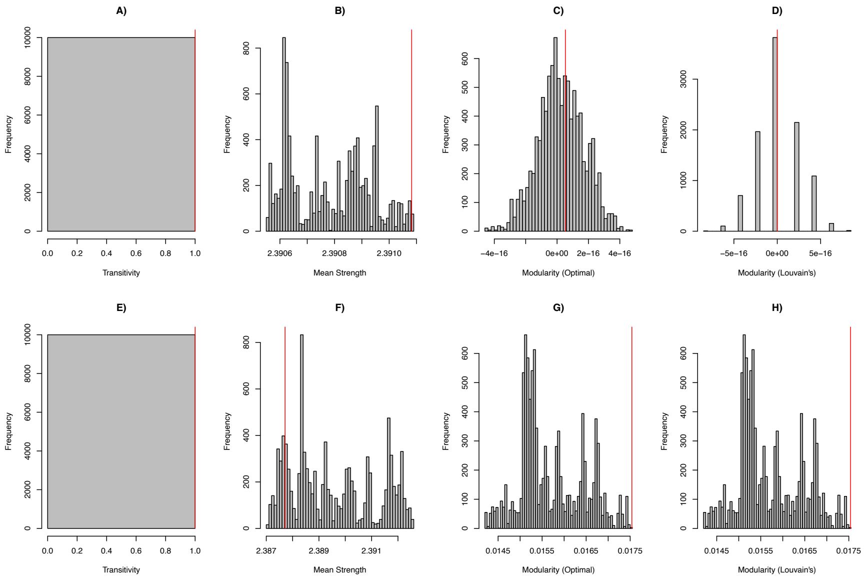


**Fig. S5**

Histogram distribution of a) Sonso Transitivity, b) Sonso mean Strength, c) Sonso Modularity, based on optimal clustering algorithm from igraph, d) Sonso Modularity, based on Louvain's clustering algorithm e) Waibira Transitivity, f) Waibira mean Strength and g) Waibira Modularity, based on optimal clustering algorithm from igraph, h) Waibira Modularity, based on Louvain's clustering algorithm measures from 10,000 data stream permutations of each social networks using adult data only and individual randomisation method. Red lines indicate measures from networks created from original party composition data

**Table S6:** D dissimilarity values between communities and between Sonso and Waibira clusters using adult only dataset. G is the community/cluster to be compare with G' (another community/cluster).

| **G** | **G'** | **D(G, G')** |
|---|---|---|
| Sonso (Full) | Waibira (Full) | 0.3573163 |
| Sonso (Full) | Waibira_A | 0.2304035 |
| Sonso (Full) | Waibira_B | 0.4876596 |

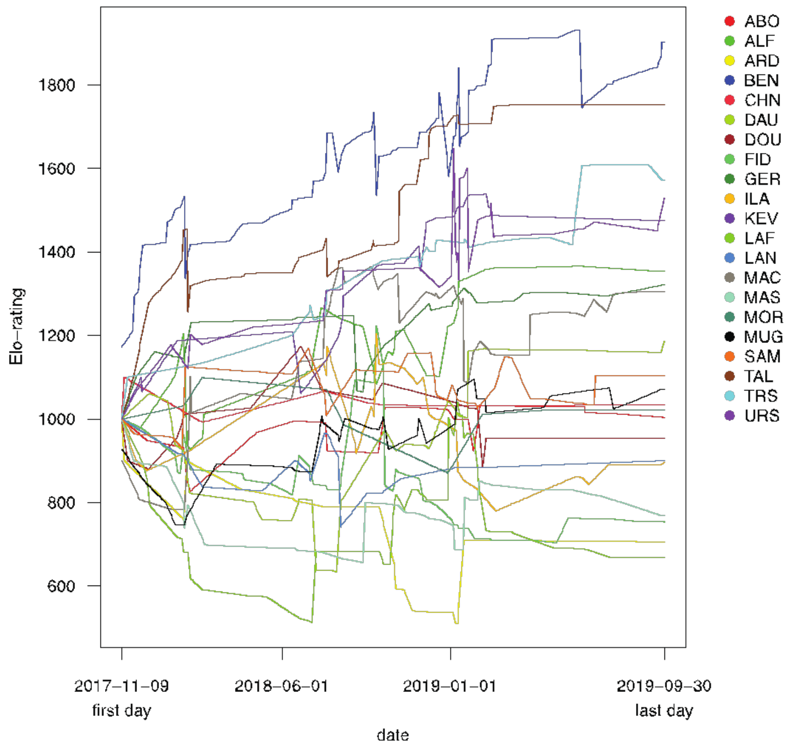


**Fig. S6** Plot showing the rank trajectory of elo-rating over the final two years of the study period for males in Waibira. We could only measure rank over the final two years of the study period because we did not have these data available before then. To calculate ranks we used the package EloRating (Neumann, 2020) in RStudio. We used pant-grunt interactions as a proxy for win-loss interaction where the individual who produced the pant grunt was the loser and the receiver was the winner. We used a starting value of 1000 and k-value of 200 and included in our dataset all pant-grunt interactions that occurred within the community (including those that involved females, and immatures). We then used the final elo-rating score for each individual at the end of the study period to determine their rank (between 1-22) with 1 being the highest ranking and 22 the lowest. Group membership: Waibira A included ALF, BEN, DOU, FID, GER, MAC, MAS, TAL, TRS, and Waibira_B included ABO, ARD, CHN, DAU, ILA, KEV, LAF, LAN, MOR, MUG, SAM, URS. No pant-grunt interactions were observed for one of the Waibira_B members (KAS)

**Table S7** t-test results testing for the difference in home range overlap between dyads within as compared to between core and periphery in the Waibira community using only the first party composition scan of each day that was recorded in a known block

| **Proportion of Home Range** | **t** | **p-value** | **Mean within cluster** | **Mean between cluster** |
|---|---|---|---|---|
| 5% | -0.78 | 0.44 | 0.32 | 0.29 |
| 25% | -0.27 | 0.79 | 0.52 | 0.51 |
| 50% | 0.52 | 0.6 | 0.7 | 0.71 |
| 75% | 0.36 | 0.72 | 0.79 | 0.8 |
| 95% | 0.45 | 0.65 | 0.86 | 0.87 |

**Table S8** t-test results testing for the difference in home range overlap between dyads within as compared to between core and periphery in the Waibira community using all party composition scans recorded within known blocks

| **Proportion of Home Range** | **t** | **p-value** | **Mean within cluster** | **Mean between cluster** |
|---|---|---|---|---|
| 5% | 0.48 | 0.63 | 0.45 | 0.47 |
| 25% | 0.21 | 0.83 | 0.57 | 0.57 |
| 50% | 0.36 | 0.72 | 0.7 | 0.71 |
| 75% | -0.07 | 0.95 | 0.83 | 0.83 |
| 95% | 0.13 | 0.89 | 0.91 | 0.91 |

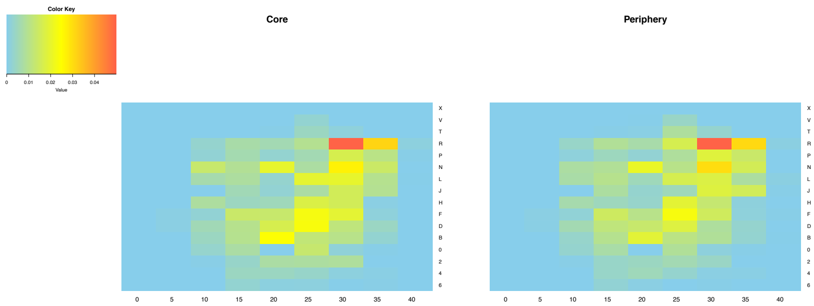


**Fig. S7** Heat maps illustrative the ranging patterns of the Waibira core and periphery clusters from the Waibira community. These maps include all party composition scans and includes all parties in which one or more individuals from the group were present. Colour key indicates the proportion scans were individuals from each group were observed in each block with red indicating the highest proportion time in the block and blue indicating no time spent in the block

**Table S9** Membership and mean Strength of core and peripheral clusters identified each year. In the membership column each three-letter code corresponds to one individual ID

| **Year** | **Group** | **Members** |
|---|---|---|
| 2015 | Circle (Core) | ALF, BEN, DAU, DOU, FID, GER, MAC, MAS, SAM, TRS |
| 2015 | Square | ABO, ARD, CHN, ILA, KAS, LAF, LAN, MOR, TAL |
| 2015 | Triangle | KEV, MUG, URS |
| 2016 | Circle (Core) | ALF, BEN, DOU, FID, GER, KEV, MAC, MAS, SAM, TAL, TRS |

| | | |
|---|---|---|
| 2016 | Square | ABO, ARD, CHN, DAU, ILA, KAS, LAF, LAN, MOR, MUG, URS |
| 2017 | Circle (Core) | ABO, ARD, BEN, DAU, FID, ILA, LAF, LAN, MUG, SAM, TAL |
| 2017 | Square | ALF, DOU, GER, KAS, MAC, MAS, TRS |
| 2017 | Triangle | CHN, KEV, MOR, URS |
| 2018 | Circle (Core) | ARD, DAU, FID, GER, ILA, LAF, LAN, MAC, MAS, MUG, SAM, |
| 2018 | Square | ABO, ALF, BEN, CHN, DOU, KAS, KEV, MOR, TAL, TRS, URS |

## S10. Testing Core-Periphery Structure

To test whether the Sonso and Waibira networks satisfy a core-periphery social structure we first had to establish whether any clusters were present in their network. If more than one cluster was identified, we measured the probability of above-chance connections within and between clusters to test the prediction that in core-periphery structures connections are more likely within one cluster (the core) than within the other cluster (the periphery). If a core-periphery structure is present, an intermediate probability of connections is expected between clusters. Probabilities were calculated using the following formula:

$$Probability = \frac{Nt}{No}$$

Where *Nt* is the number of possible connections between individuals (i.e., if all individuals were connected in the network) and *No* is the number of above-chance connections observed between individuals. Above-chance connections are edges/connections between two individuals where the DAI (edge width) is greater than the mean edge weight from 10,000 permuted networks. The use of permutation tests to calculate above-chance connections confirms that, if a core-periphery structure is observed, that structure is not a random property of these networks. Due to the fission-fusion dynamics of chimpanzee communities, every dyad will inevitably be observed in the same party at some point, not necessarily because they chose to interact. Using only above-chance connections allows us to exclude arbitrary associations between dyads that arise when individuals unintentionally spend time in the same party; keeping only connections between dyads who spend a non-arbitrary amount of time in the same party.

**Table S11**

**Table 2. Probability of edge connections between core-core, core-periphery, and periphery-periphery individuals in Waibira social network across four-year study period.**

| **Year** | **Core-core** | **Core-periphery** | **Periphery-periphery** |
|---|---|---|---|
| 2015-2019 | 0.98 | 0.46 | 0.16 |
| 2015-2016 | 1 | 0.23 | 0.12 |
| 2016-2017 | 1 | 0.41 | 0.18 |
| 2017-2018 | 0.82 | 0.44 | 0.33 |
| 2018-2019 | 0.98 | 0.48 | 0.28 |

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