Intro

**Methods**

Study site and system

The Kanyawara community lives in the northern forest of Kibale National Forest, Uganda. Over this period.

Data collection

Data were collected from August 2009 – 2017,

Analysis

From 2010 – 2017, the study examined social integration in 22 females and 16 males, for a total of 200 unique chimp-years. Social networks included all adult individuals, including males > 15 years and females > 12, with age calculated at mid-year (07/01). Members ranged from 12 – 57 yo, with an average age 26.5 +/- 11.6 years (mean +/- sd), and network membership ranging 1—8 years with an average 5.26 +/- 2.7 years. Members were included in an annual network if present for >= 6 months of the year, and if observed at least 50 hours as a focal and 100 hours as a party member during focals. Average focal observations were 133 +/- 73 hours per chimp-year.

We constructed 9 social networks based on member sex and interaction type. Networks either included both males and females (mixed-sex) or exclusively same-sex dyads. Network ties were characterized by dyadic indices of spatial proximity (resting within 5 m), total grooming (given or received), and directed grooming (grooming given). Each dyadic index was calculated by summing the number of focal point samples when the two individuals were observed interacting over a calendar year, and then dividing by the number of point samples in which the two were seen in the same party when one was a focal (as in Machanda et al., 2013).

We used the igraph package in R 3.6.1 to create network graphs and measure individual-level network integration. For each annual network, we calculated 5 metrics of integration: **betweenness** centrality, **eigenvector** centrality, **weighted and unweighted degree**, and local **transitivity** (i.e. local clustering coefficient, Hanneman & Riddle, 2005). All metrics were weighted apart from unweighted degree, in an effort to capture variation in both number of social partners and frequency of social interaction.

We calculated average annual dominance ranks (**rank**) within sex-specific dominance hierarchies. Daily ranks were based on Elo ratings informed by decided agonistic interactions, as described in Emery Thompson *et al.* (2020), and standardized relative to number of individuals in the hierarchy. We further calculated the proportion of observation days that a female was seen with a maximally tumescent swelling (**time** **swollen**) as an analytical control, as males are highly attracted to females in this state.

*Stability in integration*

To evaluate changes in network integration with age, we assembled generalized linear mixed models (glmm) in the lmerTest R package. Each integration metric was modeled as a response with a gamma error distribution and a log-link function. Each model included age-at-mid-year (**age**) and rank as fixed effects, and individual ID as a random effect. In mixed-sex networks, we included sex and its interaction with age as fixed effects to model sex differences in age-related changes in integration. We further modeled age-related changes within each sex, both within mixed-sex and in same-sex only networks. For females alone, we included time swollen as an additional predictor of integration.

We tested the significance of age-related changes in integration by creating 1000 randomized networks, where node attributes such as sex, age, rank, time swollen, and ID were assigned randomly according to the distinct set of predictors in the model. We ran our initial models on these data sets and extracted the 1000 “random” coefficients of relevant predictor variables. We then calculated the proportion of random coefficients that fell below the observed predictor coefficients, where proportions > 0.95 and < 0.05 indicated a significantly positive or negative effect of the predictor on the response. Node randomizations preserved, and thus controlled for, annual variation in network size, sex and age composition, and individual social tendencies.