Social Network Dynamics across two Affiliative, but Risky, Behaviors in Colombian Spider Monkeys (*Ateles fusciceps rufiventris*)

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Introduction

The fission-fusion social dynamic is characterized by marked unpredictability in social group composition in which members split into sub-groups and reunite by engaging in dyadic affiliative interactions. Spider monkeys engage in affiliative contact gestures known as embracing and face-embracing at the time of fusion. Previous research on the embrace behavior in spider monkeys suggests the embrace is considered a greeting behavior that serves as a signal for benign intent, especially during tension reduction (Schaffner & Aureli, 2005). While the face-embrace variation of the embrace was only recently identified, it is also considered an affiliative gesture. Boeving et al. (2017) described the face-embrace, as well as differences in physical positioning between the two behaviors, such that the embrace involves arms wrapped around the body with heads angled down towards the trunk, while the face-embrace involves close face contact absent of the arms wrapped around the body. (Fig 1). Given these differences, it hypothesized that the face-embrace is riskier than the embrace given the face contact, and that this risk may be reflected in differences in social network structure.

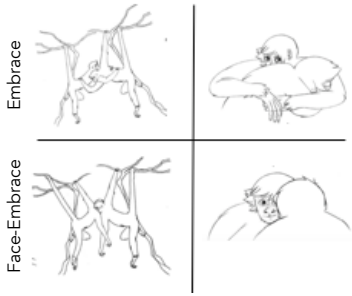

Fig 1. Two views of embrace and face-embrace

Methods

Social interactive data were exported to Excel and uploaded to Cytoscape (Shannon et al., 2003) for network analyses. Nodes denote individual monkeys. Blue nodes denote adult males while red nodes denote adult females; juveniles are denoted by green nodes. Strength of social bond is represented by weighted (i.e., thickness) edges, reflecting pair-wise frequency of interaction. Degree Centrality, or the number of direct connections, was analyzed. Individuals with high degree centrality values were placed about the center of the graph.

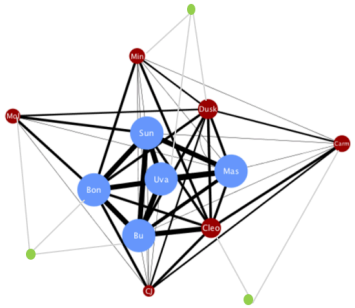

Fig 2. Embrace Network

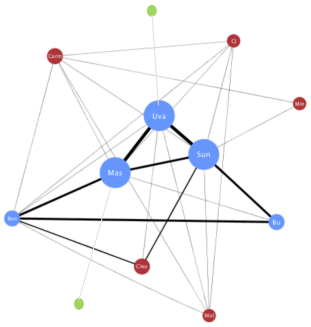

Fig 3. Face-Embrace Network

Results

Results indicate a significant structural difference between the networks, $t(19.64) = 3.38$, $p = 0.003$, in which more individuals overall were central in the embrace network (Fig 2) and only three males were central in the face-embrace network (Fig 3); no juveniles exhibited centrality in either network. Furthermore, the in-degree/out-degree analysis indicated juveniles receive both types of embraces, but almost never initiate them. We discuss these results in light of spider monkey ecology with social network analysis as a unique tool for elucidating the structure and dimension of social behavior.

Conclusion

Here we provide the first social network analysis showing differences between embrace and face-embrace. The results are in line with our prediction that more risk is associated with the face-embrace given the close face contact. However, here we build on that to suggest that this risk influences interaction partners, with a clear impact on social network structure. Connectedness within a social network can range from low to high (Fig 4). Males were central in both networks, while females ranged from moderate to low levels of connectedness. This is in line with previous work suggesting strong male alliances are an artifact of male philopatric societies. The finding that juveniles were the least connected, and only received interactions is important information relevant to the mechanics of social development. Future work should aim to utilize network analysis as a tool for elucidating differences in social development across multiple time points.

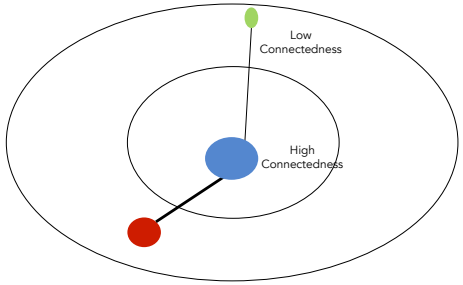

Fig 4. Connectedness diagram

References

Available upon request.

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