Social Inheritance in Animal Societies

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Extended Abstract

Many animal species live in groups that are characterised by differentiated social bonds among individuals. Network science provides a powerful framework to study animal social ties because it allows researchers to represent and quantify the relational ties that define social systems (1). Social bonds can have implications for health and survival (2), and one way in which bonds can form is through *social inheritance* where the relationships an individual forms are influenced by the social bonds of its' parents (3). The acquisition of social bonds from a parent (here, 'social inheritance') is likely to play a fundamental role in the development of social structure as a whole, shaping how information, cooperation, and even pathogens flow through animal social networks (4). Yet, our current understanding of social inheritance is limited to a small number of species often with unusual social systems but which have shown social inheritance can have implications for survival (5). By mapping social bonds as nodes and edges, it becomes possible to test whether an individual's position in the network is predicted by the position of their parents. Network science approaches help unify social inheritance into a broader, quantitative framework that can be applied across species, linking micro-level behavioural processes with macro-level social structures. Here, I present that the concepts of social inheritance can be widened to a great variety of taxonomic groups, and describe a framework that defines social inheritance universally applicable across species. Further, I discuss the mechanisms shaping social inheritance as well as the ecological and evolutionary implications. Finally, as a case study, I employ a 50-year study on Red deer to demonstrate empirical evidence for the causes and consequences of social inheritance throughout individuals' lives in the wild. As such, this research brings together current social inheritance findings, provides new empirical evidence and sheds light on how the field can be more broadly utilised. Social inheritance research has implications for animal welfare and management practices by informing conservationist of the implications of removing certain individuals from wild animal social networks. Studying social inheritance in wild Red deer requires careful attention to ethical considerations. The majority of data were collected in a purely observational manner in order to reduce disturbance to the animals, any other sample collection was conducted under Home Office project license. By embedding social inheritance research within ethical field practice and robust network science, the field can better reveal how intergenerational transmission of social ties shapes animal societies, and ultimately, their evolutionary trajectories.

References

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Figures

Figure 1. How social inheritance occurs. A focal mother ( ) has social bonds ( ) with her associates (Stage t_1). She produces an offspring ( ) who is socially bonded to her ( ) and inherits some of the mother's social bonds ( ) (Stage t_2). The offspring holds on to the bonds socially inherited from its mother and integrates them into its social network even when the mother is absent (Stage t_3). 'M' indicates the mother's node, 'O' indicates the offspring's node and 'A – D' indicate other individuals in the networks. Individual 'A' and 'B' are socially inherited by the offspring indicating transgenerational bond sharing.

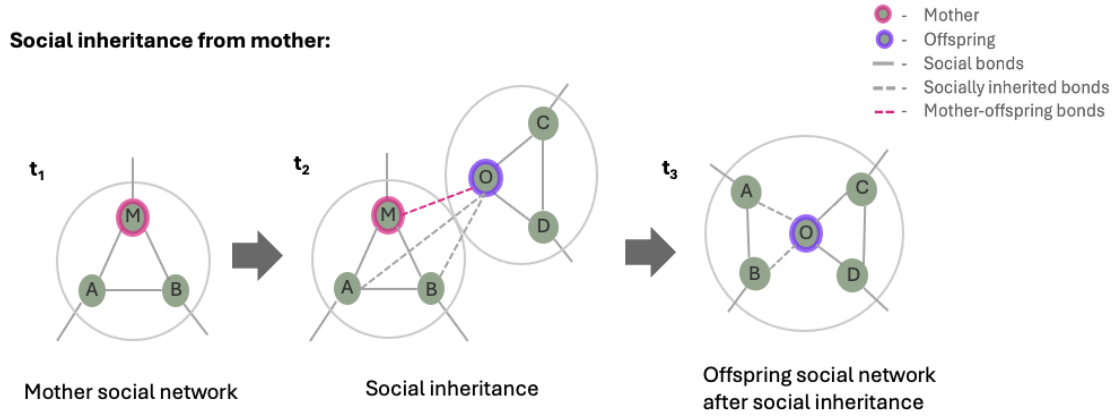

Figure 2. Social inheritance in wild Red deer. Mother and offspring social networks are compared and correlations are calculated based on the number of individual deer (unique nodes) which are present in both the mother and offspring networks (i.e. socially inherited bonds). Each plot represents a different year in a calf's life to show how social inheritance changes as the calf gets older. Correlations between mother and offspring networks are high when the calf is very young as the calf is dependent on its mother for milk. Social inheritance decreases with offspring age but remains present. Female deer (shown in red) show higher levels of social inheritance than males (shown in orange) as males disperse at approximately 3-years old, whereas, females stay closer to their mother and her associates.