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Analysis of Winner-Loser Models of Hierarchy Formation in Animals

We review winner-loser models, the currently popular explanation for the occurrence of linear dominance hierarchies, via a three-part approach. 1) We isolate the two most significant components of the mathematical formulation of three of the most widely-cited models and rigorously evaluate the components' predictions against data collected on hierarchy formation in groups of hens. 2) We evaluate the experimental support in the literature for the basic assumptions contained in winner-loser models. 3) We apply new techniques to the hen data to uncover several behavioral dynamics of hierarchy formation not previously described. The mathematical formulations of these models do not show satisfactory agreement with the hen data; key model assumptions have either little, or no conclusive, support from experimental findings in the literature. In agreement with the latest experimental results concerning social cognition, the new behavioral dynamics of hierarchy formation discovered in the hen data suggest that members of groups are intensely aware both of their own interactions as well as interactions occurring among other members of their group. We suggest that more adequate models of hierarchy formation should be based upon behavioral dynamics that reflect more sophisticated levels of social cognition.