

論文 / 著書情報
Article / Book Information

題目(和文)	小記憶容量とヒューリスティックスが促す推移的推論と社会的序列形成の進化
Title(English)	Small memory and heuristics facilitate the evolution of transitive inference and social hierarchy in a large group
著者(和文)	土井一人
Author(English)	Kazuto Doi
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Category(English)	Doctoral Thesis
種別(和文)	論文要旨
Type(English)	Summary

論文要旨

THESIS SUMMARY

系・コース： イノベーション科学 系
Department of Graduate major in イノベーション科学 コース
学生氏名： 土井 一人
Student's Name

申請学位(専攻分野)： 博士 (学術)
Academic Degree Requested Doctor of
指導教員(主)： 中丸 麻由子
Academic Supervisor(main)
指導教員(副)： 後藤 美香
Academic Supervisor(sub)

要旨 (英文 800 語程度)

Thesis Summary (approx. 800 English Words)

Social hierarchy is observed in a wide range of animals including human. Resource holding potential (RHP), a measure of an animal's capacity to win a fight against an opponent in animal contests, such as body size is considered important in the social hierarchy formation. However, RHP may be invisible or intangible in some animal social societies so that only results in animal contests can be suggestive of RHP. Assessing RHP by observing and remembering contests results should rely on cognitive abilities such as memory and recognition of others. In particular, transitive inference (TI) is critically important because transitive inference applies information of experiences by other individuals.

Transitive inference that uses known relationships to deduce unknown ones (using $A > B$ and $B > C$ to infer $A > C$ given no direct interactions between A and C) to assess RHP, is widely reported in animals living in a group. This sounds counter-intuitive because transitive inference seems to require highly developed social cognition and larger memory capacity than other inference; individuals need abilities to identify others, observe contests among others and keep the results in memory.

Our thesis employs the evolutionary simulations using the asymmetric hawk-dove game to describe an animal contest. First, we examine the coevolution of memory and transitive inference. When a cost for losers is higher than a reward for winners, we find that the immediate inference (II) strategy, which estimates the opponent's strength based on the past history of the direct fights, evolves with the large memory capacity, while the TI strategy, which estimates the unknown opponent's strength transitively, evolves with the limited memory capacity. When a cost for losers is much higher than a reward for winners, the TI strategy with the limited memory capacity has an evolutionary advantage. It is because a good way to avoid the costly fights is the prompt formation of the dominance hierarchy which does not necessarily reflect the actual rank of the RHPs; the TI strategy builds the dominance hierarchy much faster than the II strategy regardless of memory capacity, and the large amounts of information are not required for the TI strategy to form the dominance hierarchy promptly. The TI strategy tends to reinforce the hierarchy once it is built. Smaller memory capacity allows players to adjust the hierarchy well if it does not represent RHP. These results prove that transitive inference can evolve without a requirement for large memory.

Second, the relationships in larger groups become more complex. However, social cognition may not be developed adequately to handle such complexity. Instead, animals with transitive inference may apply heuristic approaches. Our thesis assumed that information processes in social cognition comprised 1) the number of benchmark members based on which individuals infer transitively, 2) the number of benchmark members shared by individuals following the same strategy, and 3) memory capacity. 1) and 2) are heuristic approaches. We examined how information processes evolve in large groups. Information process with low numbers of benchmark members could evolve in large groups when the number of shared benchmark members was high, which facilitated the application of information based on the experiences of others unlike immediate inference. Transitive inference dominated immediate inference because transitive inference could establish social hierarchy more rapidly with high as well as low numbers of benchmark members.

In sum, our thesis suggests that heuristic facilitates the evolution of transitive inference and social hierarchy under limited memory capacity.

備考：論文要旨は、和文 2000 字と英文 300 語を 1 部ずつ提出するか、もしくは英文 800 語を 1 部提出してください。

Note: Thesis Summary should be submitted in either a copy of 2000 Japanese Characters and 300 Words (English) or 1 copy of 800 Words (English).