Ann. Zool. Fennici 41: 689–690 ISSN 0003-455X
Helsinki 20 December 2004

Recognition systems: From components to conservation

Philip T. Starks

Department of Biology, Tufts University, Medford, MA 02155, USA

The ability to recognize and discriminate is assumed in studies of nepotism, mate choice, and habitat selection, among others. Interestingly, the ability to recognize and discriminate is required of the *researcher* studying these topics. Researchers may take the importance of recognition for granted because it is such an integral part of what they do in using the scientific method. Indeed, a quick scan of a few animal behavior textbooks will reveal that recognition behavior is generally allocated only a few pages within a section on kin selection, and then under the title kin recognition.

This is true even though major works on recognition systems have been published in 1987, 1988, and 1991 (Fletcher & Michener 1987, Blaustein *et al*. 1988, Hepper 1991). In a recent comprehensive chapter, Sherman and colleagues (1997) made a strong argument that recognition research is relevant across the biological disciplines. I agree and believe that recognition system theory is relevant across all levels of biological organization, for example, in studies of molecular mimicry and invasion biology. One of the goals of this special issue is to demonstrate how a recognition systems framework can be applied across taxa and across fields.

Another goal of this special issue is to present a single recognition systems vocabulary (*see* the appendix in Liebert & Starks 2004). This is an obtainable goal because there are common features in all recognition contexts, whether the item being recognized is a molecule, neighbor, or foraging site. All recognition systems require at least two participants — one that contains cues that correlate with some relevant factor, and another that evaluates these cues. We call these participants *cue-bearers* and *evaluators*, respectively. All cue-bearers must produce or acquire cues, evaluators must identify cues and compare them with a template, and evaluators must respond given the match between the cues and the template. We refer to these as separate components of recognition systems, and call them the *expression component*, the *perception component*, and the *action component*, respectively.

While a unified language is preferable, it may be unlikely that individuals studying communication will replace *signaler* and *receiver* with *cue-bearer* and *evaluator*. Similarly, individuals studying nepotism may be hesitant to forgo the terms *recipient* and *actor*. However, having a set of common terms — even if they are not universally adopted — will facilitate communication across study questions by minimizing confusion resulting from the common meaning of some words. For example, researchers studying communication use the term *receiver* for the *evaluator* and those studying nepotism use *recipient* for the *cue-bearer*. It is easy to see where confusion may arise given that *receiver* and *recipient* are synonyms used to describe different participants in a recognition context. Behavioral ecologists have been at the forefront of developing recognition systems theory, and behavioral ecologists have long recognized the value of the comparative approach — a unified language will respect the former and facilitate the latter.

The issue is subdivided into four main sections:

1. *History of recognition research* (Holmes 2004);
2. *Components of recognition systems*: expression (Tsutsui 2004), perception (Mateo 2004), and action (Liebert & Starks 2004);

3. *Model systems/concepts*: recognition of individuals (Thom & Hurst 2004), kin/nestmates (Gamboa 2004), mates (Lewis *et al*. 2004), and species (Göth & Hauber 2004); and
4. *Applications*: epidemiology (Cross *et al*. 2004), conservation (Reed 2004), and invasion biology (Payne *et al*. 2004).

While this collection covers many topics and several fields, it is far from exhaustive. In truth, it would be profoundly disappointing if this issue were exhaustive. One can easily envision additional papers exploring meiotic drive or optimal foraging from a recognition systems perspective. It is my hope that this issue will lead others to explore these topics and many, many more.

I thank all of the authors who contributed to this issue and to the referees that reviewed our work. It has been a pleasure to work with such a diverse, multi-generational group. On behalf of all authors I extend our gratitude to the Academy of Finland, Editorial Board of the *Annales Zoologici Fennici,* and Tufts University for their support. I extend a special thanks to our managing editor Krzysztof Raciborski — his effort and good humor made my job possible. Finally, I thank my wife Caroline Blackie who did not complain when I was working instead of cutting the lawn.

References

Blaustein, A. R., Porter, R. H. & Breed, M. D. (eds.) 1988: Special issue: kin recognition in animals: empirical evidence and conceptual issues. — *Behavioral Genetics* 18: 405–564.

Cross, P. C., Lloyd-Smith, J. O., Bowers, J. A., Hay, C. T., Hofmeyr, M. & Getz, W. M. 2004: Integrating association data and disease dynamics in a social ungulate: bovine tuberculosis in African buffalo in the Kruger National Park. — *Ann. Zool. Fennici* 41: 879–892.

Fletcher, D. J. C. & Michener, C. D. (eds.) 1987: *Kin recognition in animals*. — Wiley, New York.

Gamboa, G. J. 2004: Kin recognition in eusocial wasps. — *Ann. Zool. Fennici* 41: 789–808.

Göth, A. & Hauber, M. E. 2004: Ecological approaches to species recognition in birds through studies of model and non-model species. — *Ann. Zool. Fennici* 41: 823–842.

Hepper, P. G. (ed.) 1991: *Kin recognition*. — Cambridge University Press, Cambridge.

Holmes, W. G. 2004: The early history of Hamiltonian-based research on kin recognition. — *Ann. Zool. Fennici* 41: 691–711.

Lewis, S. M., Cratsley, C. K. & Demary, K. 2004: Mate recognition and choice in *Photinus* fireflies. — *Ann. Zool. Fennici* 41: 809–821.

Liebert, A. E. & Starks, P. T. 2004: The action component of recognition systems: a focus on the response. — *Ann. Zool. Fennici* 41: 747–764.

Mateo, J. M. 2004: Recognition systems and biological organization: The perception component of social recognition. — *Ann. Zool. Fennici* 41: 729–745.

Payne, C. M., Tillberg, C. V. & Suarez, A. V. 2004: Recognition systems and biological invasions. — *Ann. Zool. Fennici* 41: 843–858.

Reed, J. M. 2004: Recognition behavior based problems in species conservation. — *Ann. Zool. Fennici* 41: 859–877.

Sherman, P. W., Reeve, H. K. & Pfennig, D. W. 1997: Recognition Systems. — In: Krebs, J. R. & Davies, N. B. (eds.), *Behavioural ecology: an evolutionary approach*: Blackwell Science Ltd., Oxford.

Thom, M. D. & Hurst, J. L. 2004: Individual recognition by scent. — *Ann. Zool. Fennici* 41: 765–787.

Tsutsui, N. D. 2004: Scents of self: The expression component of self/non-self recognition systems. — *Ann. Zool. Fennici* 41: 713–727.