

their resource availability [11]. Such situations are predicted to give rise to ideal free distributions where individuals distribute themselves across the patches such that the resource intake rate in different patches is equalized. Suppose now, realistically, that the relative profitability of the different patches fluctuates over time. Socially responsive individuals can use the information provided by others to switch to more profitable patches. However, the more individuals switch, the less profitable switching becomes, because more individuals compete for the same resources. Consequently, in this simple example, social responsiveness is beneficial for some individuals in the population, but not for all.

To sum up, we have outlined three basic eco-evolutionary mechanisms that promote the emergence of adaptive between-individual differences in social responsiveness. Each of these mechanisms gives rise to an intricate frequency-dependent relation between socially responsive and socially less responsive individuals, promoting adaptive difference in social responsiveness. Interestingly, the presence of socially responsive individuals might thus often crucially depend on the presence of less responsive individuals and vice versa.

References

1 Taborsky, B. and Oliveira, R.F. (2012) Social competence: an evolutionary approach. *Trends Ecol. Evol.* 27, 679–688

- 2 McNamara, J.M. and Leimar, O. (2010) Variation and the response to variation as a basis for successful cooperation. *Philos. Trans. R. Soc. B* 365, 2627–2633
- 3 Johnstone, R.A. (2001) Eavesdropping and animal conflict. *Proc. Natl. Acad. Sci. U.S.A.* 98, 9177–9180
- 4 Dall, S.R.X. *et al.* (2004) The behavioural ecology of personality: consistent individual differences from an adaptive perspective. *Ecol. Lett.* 7, 734–739
- 5 Wolf, M. *et al.* (2011) On the coevolution of social responsiveness and behavioural consistency. *Proc. R. Soc. B* 278, 440–448
- 6 McNamara, J.M. *et al.* (2009) Evolution of trust and trustworthiness: social awareness favours personality differences. *Proc. R. Soc. B* 276, 605–613
- 7 Conradt, L. and Roper, T.J. (2009) Conflicts of interest and the evolution of decision sharing. *Philos. Trans. R. Soc. B* 364, 807–819
- 8 Johnstone, R.A. and Manica, A. (2011) Evolution of personality differences in leadership. *Proc. Natl. Acad. Sci. U.S.A.* 108, 8373–8378
- 9 Weissing, F.J. (2011) Born leaders. *Nature* 474, 288–289
- 10 Danchin, E. *et al.* (2004) Public information: from nosy neighbors to cultural evolution. *Science* 305, 487–491
- 11 Wolf, M. *et al.* (2008) Evolutionary emergence of responsive and unresponsive personalities. *Proc. Natl. Acad. Sci. U.S.A.* 105, 15825–15830
- 12 Dubois, F. *et al.* (2010) Learning in a game context: strategy choice by some keeps learning from evolving in others. *Proc. R. Soc. B* 277, 3609–3616

0169-5347/\$ – see front matter © 2013 Elsevier Ltd. All rights reserved.

<http://dx.doi.org/10.1016/j.tree.2013.01.006> Trends in Ecology & Evolution, May 2013, Vol. 28, No. 5

Social competence vs responsiveness: similar but not same. A reply to Wolf and McNamara

Barbara Taborsky¹ and Rui F. Oliveira^{2,3}

¹ Behavioural Ecology, Institute of Ecology and Evolution, University of Bern, Wohlenstrasse 50A, CH-3032 Hinterkappelen, Switzerland

² Instituto Superior de Psicologia Aplicada, Unidade de Investigação em Eco-Etologia, Rua Jardim do Tabaco 34, 1149-041 Lisboa, Portugal

³ Champalimaud Neuroscience Programme, Instituto Gulbenkian de Ciência, Rua da Quinta Grande 6, 2780-156 Oeiras, Portugal

In a recent article in *TREE* [1], we proposed an evolutionary conceptual framework for the study of social competence, suggesting that the ability of individuals to optimise the expression of their social behaviour depending on social information is a key component of their Darwinian fitness. Wolf and McNamara [2] commented that an important aspect missing in our concept is that interindividual variation in social competence should exist within a population, and they outlined different eco-evolutionary scenarios promoting such interindividual variation. Furthermore, they equate the concept of social competence with that of social responsiveness.

We fully agree with Wolf and McNamara's proposal [2] that adaptive evolution should generate mixtures of socially competent and socially less-competent individuals within a population. However, we think that their claim, that

we omitted the aspect of interindividual variation, is unjustified, and we think that the concepts of social competence and social responsiveness differ from each other in important ways.

First, the topic of interindividual differences was explicitly addressed in several parts of the original article, in particular in a section on 'An evolutionary framework for the study of social competence'. There, we outlined that social competence is a performance trait, one of the key properties of which is variation between individuals in a population [3]. However, we did not discuss explicitly the potential selective forces leading to a mix of social competence phenotypes in a population. The evolutionary forces envisaged by us to generate variation in social competence differ from the scenarios proposed by Wolf and McNamara [2], as we explain below.

Second, Wolf and McNamara's [2] synonymous use of the terms 'social responsiveness' and 'social competence' is

Corresponding author: Taborsky, B. (barbara.taborsky@iee.unbe.ch).

misleading. This mixes up two different concepts that might superficially appear similar. The authors do not provide a formal definition of social responsiveness, but from the evolutionary scenarios they present, 'social responsiveness' seems to refer to the degree to which individuals respond to social information. In these scenarios, individuals can adopt one of two strategies, responding to social stimuli or ignoring them (e.g., [4,5]). Thus, variation in social responsiveness exists along a single dimension; social information is used to a higher or lesser degree. If individuals are responsive and use external information, they do so by following fixed rules. This includes showing the best possible response to the last move of an opponent (scenario 1), copying the most recent choice of another group member (scenario 2), or choosing the most profitable patch by using social information revealing the state of available patches (scenario 3). By contrast, 'social competence' refers to the ability of an individual to optimise its social behaviour depending on social information [1]. The concept of social competence not only describes the extent to which external information is used, but also incorporates the ability to respond adequately to social information. Individuals with low social competence can arise from either (i) not taking social information into account (in which case, they are similar to individuals with low social responsiveness), or (ii) showing a high but wrong response (in which case, an individual with high social responsiveness can have low social competence). Thus, variation in social competence can arise from variation in the weight given to social information (i.e., social responsiveness) and/or from variation in the ability to express an appropriate response to social information. Therefore, in contrast to social responsiveness, which represents a behavioural strategy, social competence refers to an ability. It is difficult to imagine how a lack of an ability, which may lead to poor performance in a particular social context, should become evolutionary stable through fitness payoffs obtained in that particular context.

Finally, because of the general differences between a behavioural strategy and the ability of an animal to conduct an ecologically relevant task (performance trait [3]), the eco-evolutionary framework leading to variation in social competence is unlikely to be based on frequency-dependent decisions within the same behavioural context, as it does in the case of social responsiveness. Individuals performing poorly in the social domain should always be outperformed by individuals performing well in the same domain. However, the environment and the selective forces usually differ between individuals of a population. For example, in cooperatively breeding species, a high ability to cope with social challenges (social competence) may be important for members of large social groups, whereas the ability to evade predation may be more important in small groups, which provide less protection against predator attacks. Given that the acquisition of different abilities can be assumed to be costly, trade-offs are likely to exist between the acquisition of different abilities. Thus, decisions across different ecological and behavioural contexts can lead to adaptive variation in social competence.

References

- 1 Taborsky, B. and Oliveira, R.F. (2012) Social competence: an evolutionary approach. *Trends Ecol. Evol.* 27, 679–688
- 2 Wolf, M. and McNamara, J.M. (2013) Adaptive between-individual differences in social competence. *Trends Ecol. Evol.* 28, 253–254
- 3 Irschick, D.J. *et al.* (2008) How does selection operate on whole-organism functional performance capacities? A review and synthesis. *Ecol. Evol.* 10, 177–196
- 4 Johnstone, R.A. and Manica, A. (2011) Evolution of personality differences in leadership. *Proc. Natl. Acad. Sci. U.S.A.* 108, 8373–8378
- 5 Wolf, M. *et al.* (2008) Evolutionary emergence of responsive and unresponsive personalities. *Proc. Natl. Acad. Sci. U.S.A.* 105, 15825–15830

0169-5347/\$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
<http://dx.doi.org/10.1016/j.tree.2013.02.005> Trends in Ecology & Evolution, May 2013, Vol. 28, No. 5

Managing invasive species amidst high uncertainty and novelty

Brendon M.H. Larson¹, Christoph Kueffer², and the ZiF Working Group on Ecological Novelty*

¹ Department of Environment and Resource Studies, University of Waterloo, Waterloo, ON N2L3G1, Canada

² Institute of Integrative Biology – Plant Ecology, ETH Zurich, CH-8092 Zurich, Switzerland

Most conservation biologists would agree that the spread of non-native species is undesirable and should be prevented whenever possible. This view was recently criticized by Davis *et al.*, who argued that organisms should be

assessed on their negative environmental effects rather than on whether they are native or not [1]. In a recent article in *TREE*, Simberloff *et al.* take issue with their critique, demonstrating that great progress has been made in understanding and managing the negative effects of biological invasions, and proposing that the proper role of scientists is to educate people about these negative effects and thereby to inform societal debate [2]. As an

* Corresponding author: Larson, B.M.H. (blarson@uwaterloo.ca).

* The other members of the ZiF Working Group on Ecological Novelty are Antje Brock, Peter Edwards, Matthias Gross, Marcus Hall, Eric Higgs, Anke Jentsch, Jonathan M. Jeschke, Alexandra-Maria Klein, and Brian Wynne..