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Measuring cognition will be difficult but worth it: a response to comments on Rowe and Healy

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In our review (Rowe and Healy 2014), we argued that taking too literally the approaches from the experimental psychology literature to measure cognitive abilities in individuals is fraught with problems. It is cheering to see that at least some others agree with this view (Barrett 2014; ten Cate 2014). For the reasons we outlined in that review we continue, however, to be wary of the interpretation of data produced from artificial tasks (Quinn et al. 2014), batteries of tasks on the same individuals (Thornton 2014; Thornton et al. 2014) and psychometric testing (Kölm 2014; Thornton 2014; Thornton et al. 2014). For example, animals will bring their experience to bear on their performance in novel artificial tasks (Quinn et al. 2014), and psychometric tests will reflect an animal's sensory and motor skills as well as its cognitive capabilities (Nachev and Winter 2012).

We are more disappointed to see that another of our messages seems to have been missed, so we will reiterate that we think behavioral ecologists bring a different perspective and an invaluable new approach by addressing questions concerning the adaptive nature of cognition. While the experimental psychologist sweeps aside individual variation in task performance due to their focus on general mechanisms and principles, the behavioral ecologist trained in how natural selection optimizes in the face of trade-offs seeks to understand the causes and consequences of that variation, both inter- and intraspecific. Importantly, based on a deep understanding of an animal's or species' ecology, the behavioral ecologist can bring the power of hypothesis testing to bear on questions that address the role that cognition might play in that animal's survival and/or reproductive success. Here we would also suggest that the plan to use a "standard" test or a battery of tests misses the point: optimization means that cognitive abilities will themselves be traded off against other capabilities and Rambo will beat Einstein some of the time.

Testing more species (Kölm 2014) and remarkable species (Thornton 2014) may, indeed, give some fascinating insights into what different species can do. "Cognitive taxonomy," or the natural history of cognition, is a useful starting point for identifying variation in cognition found across species. We would suggest, however, that one might choose one's remarkable species with some care, with a view to both the biological and logistic value of the choice. For example, the knowledge that some birds store food and other, closely related, species do not, lead to work addressing the role that spatial memory, and the hippocampus, play in that behavioral variation (e.g., Biegler et al. 2001). Similarly, if one wished to determine the adaptive role that cognition plays in female choice, then the choice of species would not be a food storer but one in which females vary in the degree to which they exercise mate choice. Here a female bowerbird or a peahen might be the animal of interest. We urge researchers not just to measure cognitive abilities in their study species because they feel it's timely. Hypothesis-driven science is what behavioral ecologists are good at and playing to that strength surely leads to more robust advances in understanding how selection acts on cognitive abilities.

Finally, we would like to reiterate that we did not intend to dissuade anyone from investigating variation in cognitive abilities (Quinn et al. 2014). This is a misunderstanding we want to correct. We do want to see such investigations (and the more the merrier). But we emphasize again that researchers need to ensure that they can identify the relevant cognitive trait(s). Unless we can robustly do that, we suggest our own "sticking plaster" solution, which is to encourage researchers to recognize the fact that an animal's performance in their cognitive tasks does not necessarily depend upon its cognitive ability.

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