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Letter Response

Response to Gibbons *et al.*: Null-hypothesis significance tests in education and inference

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We welcome the comments of Gibbons *et al.* [1] and the opportunity to clarify several points raised in our earlier article [2]. We will deal with their three concerns in order.

Gibbons *et al.* [1] question whether null-hypothesis significance test (NHST) methods should be taught to ecologists. However, 'professional agreement on statistical philosophy is not on the immediate horizon' [3] and 'no philosophical war has been won to support an emerging consensus' [4]. These observations alone indicate that frequentist methods should be taught in introductory statistics courses for ecologists. By contrast, there are compelling reasons for hesitating to teach Bayes in introductory statistics courses [5,6], and even those preferring a Bayesian approach can benefit from a proper understanding of frequentist methods [7]. Reese [8] advocates introducing a 'quasi Bayesian' approach early in statistical education: students should understand that calculating statistical significance is a tool, a step in a process. Even within an NHST framework, interpreting a result requires placing new data and its analysis in the context of previous scientific knowledge.

Gibbons *et al.* [1] are concerned that we have advocated self-teaching by ecologists, using only materials available in the ecological literature. We did not mean to imply that this should be the case and, like Hobbs and Hilborn [9], we believe that much will be gained by ecologists and statisticians working together to design new courses for ecological statistics. Although we are doubtless guilty of some parochialism in our use of literature, our focus was meant as a description of the state of affairs in ecology and not as a prescriptive guide to what ecologists must read to become statistically literate.

We agree with the contention of Gibbons *et al.* [1], that statistical methods are not routes to automatic falsification of hypotheses. However, we maintain that, for many, NHST will continue to have a strong part to play in hypothesis falsification. This is particularly the case given the focus on explanation that characterizes frequentist methods [10].

Among ecologists, Gibbons *et al.* [1] are not alone in believing that alternatives to NHST are more intuitive and easier to understand and, hence, should be the exclusive focus of statistical education for ecologists. By contrast, our sense is that ecologists should devote their energies to ecology, rather than to arguing about issues on which professional statisticians cannot agree. We suggest that ecologists would be wise to adopt the eclectic pragmatism of many statisticians and use a variety of statistical tools as appropriate, without declaring a commitment to a single statistical faith [11].

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Available online 12 July 2007.