CORRESPONDENCE

To the Editor,

A recent special issue of *Perspectives on Psychological Science* (Pashler & Wagenmakers, 2012, available online) makes a compelling case for the need to improve significantly the methodology in psychological research. Those articles should be required reading for all behavioral and social researchers, and are widely applicable for parapsychological research. In fact, the controversial nature of parapsychology makes those methodological points of special relevance. The key points and their applicability to parapsychological research are noted below.

Confirmatory experiments. The overall conclusion of the special issue is that well-designed confirmatory experiments are needed to provide convincing evidence and scientific progress. The 13 articles on methodology in the special issue discuss various aspects of this conclusion. The great majority of experiments in psychology and parapsychology have been conducted with the more informal methodological practices of exploratory research, rather than with the more systematic methodology of well-designed confirmatory research (Nosek, Spies, & Motyl, 2012; Open Science Collaboration, 2012; Kennedy, 2013a; Wagenmakers, Wetzels, Borsboom, van der Maas, & Kevit, 2012). The current scientific culture provides much greater incentives for novel exploratory research than for more convincing confirmatory research. However, available evidence indicates that the lack of well-designed confirmatory studies has produced a high level of false findings (Bakker, van Dijik, & Wicherts, 2012; Ioannidis, 2012; Nosek, Spies, & Motyl, 2012). The widely held assumption that science is self-correcting is true only if appropriate confirmatory studies are conducted and published. Exploratory research promotes scientific creativity, and confirmatory research provides scientific validity. Both are essential.

Power analysis. The need for power analysis to develop appropriate sample sizes for confirmatory experiments is a recurring theme in the special issue (Bakker, van Dijik, & Wicherts, 2012; Ioannidis, 2012; Open Science Collaboration, 2012; Pashler & Harris, 2012) and has also been discussed for parapsychological research (Kennedy, 2013a). Underpowered experiments are a biased research strategy because significant results are interpreted as evidence in favor of an effect, but nonsignificant results are inconclusive. Nonsignificant results could be due to the lack of power or to the experimental hypothesis being false. However, for studies with adequate power, nonsignificant results are evidence that the experimental hypothesis is false.

Study registration. Pre-registration of the planned hypotheses and statistical methods for confirmatory experiments eliminates many difficult-to-detect biases that are pervasive in experimental research (Nosek, Spies, & Motyl, 2012; Wagenmakers, Wetzels, Borsboom, van der Maas, & Kievit, 2012). One of the most widely discussed biases is failure to report experimental results that did not turn out as the experimenter hoped. This can occur for the entire experiment or for certain hypotheses when multiple hypotheses are investigated. Another source of bias is planning vague hypotheses for an experiment and developing the specific hypotheses and statistical tests as the data are being explored during analysis. Similarly, post hoc or exploratory analyses can be reported in a way this is mistaken for planned analyses. Publicly accessible, prospective study registration is standard practice in clinical trials in medical research and is increasingly required for publication in medical journals (De Angelis, et al., 2004; U.S. National Institutes of Health; 2012). The value of study registration has been noted many times in parapsychology (see Kennedy, 2013b).

The Koestler Parapsychology Unit (2012) at the University of Edinburgh now provides a simple, public registry for parapsychological experiments. Other registries for scientific research are being developed, but not all are publicly accessible. The field of parapsychology will have much greater credibility if confirmatory studies are prospectively registered at a public registry.

Multiple-experimenter designs. Experimenter fraud has occurred in all areas of science (Strobe,

Postmes, & Spears, 2012). However, the controversial nature of parapsychological research combined with the prominent experimenter differences in producing effects make experimenter misconduct particularly salient in parapsychology. Experimenter fraud has occurred many times in parapsychology and is a constant threat (Kennedy, 2013b).

Contrary to what many scientists assume, Strobe, Postmes, and Spears (2012) reported that independent replication and peer review are generally not effective at detecting or deterring scientific fraud. Their analysis found that most frauds have been detected by co-worker whistleblowers. They noted that "whistleblowers are likely to remain the single most effective instrument against scientific cheating" (p. 682). These conclusions are consistent with the experience with experimenter fraud in parapsychology (Kennedy, 2013b). The lack of implementation of effective practices to detect and deter experimenter fraud makes undetected cases likely.

Several parapsychological researchers have noted the need for multiple-experimenter procedures that make intentional or unintentional data alterations by one experimenter difficult (see Kennedy, 2013b). Multiple experimenter study designs recognize the importance of co-workers in preventing misconduct and should be an accepted experimental practice for confirmatory parapsychological experiments. The procedures should include independent verification or validation of software used for data collection or analyses. Procedures that make intentional or unintentional data alterations difficult, including software validation, are expected in pivotal pharmaceutical research (Kennedy, 2013b).

Data Sharing. Sharing of raw data for independent analysis is another strategy that is effective for detecting and deterring experimenter fraud—as well as for catching other types of methodological errors and promoting optimal use of data (Nosek, Spies, & Motyl, 2012; Strobe, Postmes, & Spears, 2012). As discussed in Kennedy (2013b), confirmatory data should be collected, managed, and analyzed with the expectation that the data will be provided to others for critical scrutiny. The raw data could be made openly available. However, when post hoc data fishing is likely, an original investigator may reasonably require that a recipient register the planned analyses publicly, including corrections for multiple analyses, prior to receiving copies of the data. An optimal strategy might be to make part of the data openly available for exploration and part of the data available only for registered confirmatory analyses.

Final thoughts. These practices can significantly increase the credibility of a study, particularly the credibility with those who find methodological bias and experimenter misconduct to be more plausible than psi. It would be appropriate for parapsychological researchers to be leaders in this coming wave of methodological advances.

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