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## Editorial

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In 1960, the newly founded Society for Psychophysiological Research captured the already considerable breadth of the just-forming field of psychophysiology. The Society began publishing *Psychophysiology* in 1964 with the mandate to address that breadth. As the field has grown rather enormously in the past 40 years, the journal has expanded accordingly. Whole new (and still overlapping) fields such as behavioral medicine have taken root, and new technologies such as hemodynamic brain imaging continue to enrich the psychophysiologicalist's toolbox. Beyond important domains of clinical, developmental, and human-factors application and exciting methodological developments, psychophysiology has made great progress on basic substantive questions such as the relationship of fundamental reflexes to emotional behavior and the role of regional brain specialization in perceptual and cognitive function. In so doing, the field has necessarily faced up to conceptual challenges such as what is involved in manipulating emotion in the laboratory and in verifying the manipulation.

The journal's breadth and visibility serve it well in attracting and accommodating a wide range of appropriate papers. Since becoming editor in January 1998, I have instituted no change in the journal's scope or emphasis, but I have taken every opportunity to educate people on its breadth, because the scope of the field and of the journal is sometimes underestimated. One of the tasks in editing *Psychophysiology* is responding to occasional queries about whether a prospective submission would be appropriate for the journal. Some discussion here on the scope of the journal may be helpful.

### The Domain of Psychophysiology

The two most common misunderstandings I encounter are that *Psychophysiology* as a journal is largely confined to non-central nervous system (non-CNS) measures and that psychophysiology as a field does not subsume what are commonly referred to as brain imaging methods. On the contrary, both the field and the journal have been evolving continuously from early roots, becoming broader while remaining an outlet for more traditional work. As an example of this evolution, the term *behavioral medicine* was first used in a publication (Birk, 1973) well after psychophysiology began to organize itself as a discipline. In that sense, psychophysiology long predated behavioral medicine, which has since developed into a major discipline of its own, overlapping and enriching a number of other disciplines. That much of behavioral medicine was and is

strongly grounded in psychophysiology does not preclude its strong relationships to learning theory, social and personality psychology, physiology, medicine, and other fields. Much of behavioral medicine can be seen as the application of research on autonomic, striate muscle, and other non-CNS phenomena that have been a central part of psychophysiology since its inception.

Being formally trained in behavioral medicine, I value its broad roots, its impressive evolution, and its broad applicability. Such breadth fosters progress and impact. *Psychophysiology* has become and will remain an important outlet for behavioral medicine papers. There are important roles for journals devoted specifically to behavioral medicine, as well as for broader venues such as *Psychophysiology*. These choices in publications are entirely healthy for the field.

There is no question that *Psychophysiology* has long published much non-CNS work and will continue to do so. But the field, and the journal, evolve. In the early days of the journal, most papers in the journal relied on non-CNS measures. Inspection of any recent issue will make clear that direct CNS measures now have a substantial presence. The journal has broadened its reach, without losing its early interests.

The second and more puzzling misunderstanding is the frequent characterization of functional brain imaging as distinct from psychophysiology, perhaps related to the misconstrual of the term *brain imaging* as confined to hemodynamic brain imaging. It is difficult to imagine a measure more obviously psychophysiological than functional magnetic resonance imaging (fMRI), for example, given the widely accepted definition published in this journal's first issue: "any research in which the dependent variable is a physiological measure and the independent variable a 'behavioral' one should be considered psychophysiological research" (Stern, 1964, p. 90). This definition of our field remains current (e.g., Davidson, 1998). Brain imaging dates at least to the electroencephalogram (EEG) toposcope displays of Walter and the maps of Rémond of 40+ years ago. There may be several reasons for misunderstanding the nature of newer brain imaging technologies and their relationship to the rest of psychophysiology.

One reason is that much of the technology for some newer brain imaging methods arose in a discipline (radiology) without strong historical connections to psychophysiology. That problem will no doubt prove self-correcting, as researchers using those methods but lacking in the generalist training that characterizes psychophysiology encounter challenges traditional psychophysiology has long faced and in many cases addressed successfully. An example is the just-emerging understanding in the hemodynamic imaging literature that randomization rather than blocking of the order of stimulus or task conditions is crucial for many kinds of

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hypotheses, an issue that the event-related potential (ERP) literature discovered and resolved early on (e.g., Hillyard, Hink, Schwent, & Picton, 1973; Näätänen, 1975; Spong, Haider, & Lindsay, 1965).

A second reason for misconstruing hemodynamic imaging as other than a subdiscipline of psychophysiology is an assumption, too common even among traditional psychophysiologicalists, that peripheral measures are appropriate only for studying peripheral and “lower” processes, whereas CNS measures are necessary for studying central and “higher” processes. As many readers of this journal know, there is a vast literature on autonomic measures of cognition (e.g., Jennings, 1986). Researchers using hemodynamic brain imaging methods (and some EEG researchers) are often unaware of that literature. Conversely, peripheral psychophysiologicalists are often unfamiliar with the extensive EEG literature on some of the concepts and processes that have been important in the autonomic literature such as conditioning, habituation, and emotion, although such research has a long history (e.g., Jasper & Shagass, 1941). It is not surprising that some hemodynamic imaging researchers, coming out of a distant tradition, are often unaware of the large and highly relevant peripheral and central electrophysiology literatures. *Psychophysiology* spans peripheral and central measures and mechanisms, and electrophysiological and hemodynamic measures and mechanisms. The journal strongly encourages submission of papers that integrate or contrast multiple measures. Convergent and divergent measures are often crucial as a manipulation check. The demands of mastering multiple methods are high, but the best science demands it.

A final hypothesis about the misconstrual of newer brain imaging methods is a failure to realize the potential for combining them with other psychophysiological methods. For example, it is common to assert that source localization via EEG is markedly inferior to that achievable via hemodynamic imaging. The implicit comparison in such a statement is usually between EEG (traditionally recorded with far fewer channels than is now becoming feasible, and without structural MRI coregistration) vs. a combination of structural MRI and a coregistered functional hemodynamic measure. That comparison is not very interesting. The sensible comparison, if one is interested in the relative limits of the methods, would be EEG (with structural MRI) and fMRI (with structural MRI). In the past, EEG has been much more widely available than structural MRI, so it is understandable that so few studies combining those measures are available. But we should not be judging the potential of these methods based only on what we have already achieved with them. For example, the relative limitation in temporal resolution of current hemodynamic imaging methods will surely improve with technological innovation. Similarly, the relative limitation in spatial resolution in EEG will improve with structural MRI coregistration and advances in localization algorithms, as illustrated recently in this journal (O'Donnell et al., 1999). Magnetic source imaging (MEG with structural MRI) has already progressed in that regard, matching EEG's temporal resolution and matching or exceeding fMRI's spatial resolution in many cases. It is becoming more widely appreciated that adequate solutions can be obtained to the formally intractable inverse problem for identifying source generators from MEG and EEG data (e.g., Huang et al., 1998). Surely the integration of autonomic nervous system (ANS) and CNS measures, of EEG and fMRI, and so on, in ways that capitalize on their respective strengths (e.g., Lang et al., 1998) will best serve our science.

The value of multimeasure approaches has been clear to psychophysiologicalists for half a century (e.g., Ax, 1953). What might be

construed as traditional psychophysiology welcomes hemodynamic methods into the fold, offering its decades of experience in experimental design and data analysis and demonstrating the value of combining a variety of kinds of physiological measures. It would be unwise to declare whether temporal or spatial resolution, or function or structure, is the more important. A comprehensive science will need to work out all of those facets. Meanwhile, we should not be too hard on newer subdisciplines that necessarily rely on relatively crude methods and struggle to reinvent wheels. Those methods will improve, perhaps rapidly, and “traditional” psychophysiologicalists can foster that evolution.

*Psychophysiology* already publishes papers using the newer methods of physiological measurement. They will not come to dominate any more than any other measurement domain does. The journal will remain a premiere outlet for psychophysiological research, broadly conceived. Behavioral medicine, human factors, and clinical, cognitive, and affective neuroscience, all broadly conceived, will be welcomed enthusiastically. And of course the journal will be open to old and new approaches that may fall outside those categories.

Beyond a collaboration of measures, *Psychophysiology* will promote a collaboration of substance. Some of the highest-impact papers will include powerful tests of explicit hypotheses that link psychological phenomena to multiple biological mechanisms and measurement systems. Such work will often require collaborations between psychologically oriented psychophysiologicalists and experts in other biomedical disciplines. For example, studies of mechanisms in terms of neurochemistry, psychopharmacology, genetics, and disease processes are appropriate for submission when they relate to physiology-behavior phenomena in humans. The psychological or biological mechanism of interest is the key criterion, not the choice of measure.

Although in recent years some colleagues have expressed to me concerns that psychophysiology as a discipline will someday fracture, I do not see it in journal submissions (rising annually for some time now), in the content of the annual meetings of the Society for Psychophysiological Research (also enjoying record paper submissions in recent years), or in the intellectual substance that defines the discipline. For some time, psychophysiology has been too big for a single publication to be the only outlet for its contributions. Psychophysiology is a healthy field, healthy enough to celebrate specialty conferences, specialty publications, and specialty organizations that serve the evolving needs of the discipline, and we have no trouble sharing our subdisciplines with other disciplines such as neurology, clinical psychology, behavioral medicine, or neuroscience. *Psychophysiology* will remain a vital forum for integrative papers that tie these many specialties together as well as a premier outlet for more focused work on specific issues and measures.

### The Review Process

How does the journal deal with such a broad mandate? A diverse, respected Board of Associate Editors makes it possible to continue the journal's traditions of quality and breadth given a healthy discipline and a growing submission rate. I have taken the opportunity to appoint the largest and most diverse editorial board the journal has had. I am deeply grateful to colleagues who have consented to serve on the Board. They receive neither remuneration nor even a budget to cover mailing expenses. They serve out of commitment to fostering the best possible science in our discipline. Although all submissions are routed through my office, most

are assigned to an appropriate associate editor, to whom I grant full autonomy to select reviewers, evaluate the manuscript, and make an editorial decision. In most cases the associate editor is able to make a decision based on his or her own expertise and close reading of the paper, as well as on expert reviews. *Psychophysiology* prides itself on the substantive quality of the action letters the associate editors write. We see the review process as an important opportunity to develop the field via expert feedback to investigators and reviewers. Toward this end, we are committed to diversity among our reviewers. We invite scientists at any career stage who are interested in reviewing for the journal to contact me (gamiller@uiuc.edu), and I will pass your name and areas of expertise on to the associate editors.

If there is a problem facing the journal, it is one aspect of the review process. The associate editors have noted an increase in the frequency with which prospective reviewers decline to review a submission or decline to respond to queries about the status of a review. We have discussed a variety of measures to combat this problem, but none is entirely satisfactory. Peer review depends crucially on the good will of top-quality scientists giving their time to critique and improve the submissions of their peers. We work hard to provide the fastest possible turnaround on submissions, but the primary constraint is our ability to obtain high-quality reviews.

### Preparing Submissions

Several comments can be offered to facilitate preparation of manuscripts for submission. First, one of the contributions of the journal has been encouraging the development of consensus guidelines on research and publication involving particular domains of methodology. To date, *Psychophysiology* has presented committee reports on electrodermal activity (Fowles et al., 1981), heart rate (Jennings et al., 1981), electromyography (Fridlund & Cacioppo, 1986), impedance cardiography (Sherwood et al., 1990), laboratory disease transmission (Putnam, Johnson, & Roth, 1992), EEG (Pivik et al., 1993), blood pressure (Shapiro et al., 1996), and heart rate variability (Berntson et al., 1997). The March issue of the year 2000 volume will present a paper on ERP methods (Picton et al., in press). The field owes a debt to the many scientists who contributed to these papers and to former editors David Shapiro, Michael Coles, and John Cacioppo, who appointed the committees. These papers should not be understood as stipulating an inflexible journal policy for what is acceptable research, but authors should be familiar with them. For the reader's convenience, a complete set of citations is included at the end of this editorial.

Second, the January, 1999, issue included revised Instructions to Contributors, bringing manuscript preparation guidelines in line with the *Publication Manual of the American Psychological Association* (APA, 1994). The Instructions to Contributors are published in each issue of the journal and are also on the journal's web

site via [www.cup.org](http://www.cup.org). Although more of the review process is being done electronically, the initial submission is still done via hard copy. It is very important that authors consult the Instructions in preparing submissions.

Third, *Psychophysiology* continues its interest in issues concerning the analysis of psychophysiological data, such as the repeated-measures designs that are so pervasive in our field (Kesselman, 1998). The journal does not have rigid rules about how experiments are to be analyzed. The burden of making a case for the design and presentation of analyses in a given experiment is on the author. The journal actively encourages innovative applications and critical discussions of particular relevance to psychophysiological data (e.g., Greenwald, Gonzalez, Harris, & Guthrie, 1996; Wasserman & Bockenholt, 1989). Explicit judgment calls are often needed, for example, on the relative power and appropriateness of univariate and multivariate analyses of variance in the analysis of repeated measures, as discussed by Vasey and Thayer (1987). Authors may turn to these sources in developing the rationale for their analytic approach.

Fourth, the journal continues its tradition of encouraging theoretical and review papers, in addition to empirical and methodological studies. Invited book reviews, announcements about meetings of interest to our readers, and descriptions of employment and fellowship opportunities are published occasionally. Letters to the editor are not accepted.

Finally, in addition to those formal submission guidelines, I wish to encourage investigators to consider the generalizability of their work, both in designing studies and in interpreting results in publications. Generalizability depends on many important things, but I would particularly like to encourage investigators to consider the potential demographic diversity of their samples and of the populations to which they wish to generalize. The United States National Institutes of Health mandates extensive consideration of age, gender, and ethnicity in applications for research funding. It might be argued that social class, health status, or other features are equally important to generalizability for a given study. *Psychophysiology* has no interest in legislating characteristics of subject samples, but demographic diversity has often received less attention than it warrants. An international journal exists in the context of enormous diversity. The potential beneficiaries of a given study are far more diverse than the sampling for any given study can fully accommodate. Investigators are encouraged to consider how their work can speak to, and about, the widest possible audience.

The quality of the journal depends on the quality of the submissions, the hard work and good judgment of the associate editors, the wisdom and responsiveness of the reviewers, the diligence of my editorial assistant, Marsha Healy, and the professionalism of the production editor at Cambridge University Press, Bonnie Kelsey. Thanks are due to all of these individuals for the continued excellence of the journal.

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