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Psychophysiology in Australasia. Selected papers from the 22nd Annual Meeting of the Australasian Society for Psychophysiology, ASP2012, held at the University of New South Wales, Sydney, Australia, 28-30 November 2012

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Abstract

Editorial

The idea of a Special Issue of the International Journal of Psychophysiology focusing on research "down under" emerged in 2012 from discussions between the Society President (Robert Barry), the journal Publisher (Shamus O'Reilly), and the Editor-in-Chief (Connie Duncan). It was greeted with enthusiasm by the Society Executive, who set up an Editorial Committee to progress the project, beginning with establishment of timelines, evaluations of the conference abstracts accepted for presentation at the 2012 meeting of the Australasian Society for Psychophysiology, ASP2012, and critical scrutiny of each conference presentation. Formal invitations for selected authors to contribute to the Special Issue followed the conference. Members of the ASP Editorial Committee then served as Action Editors for the Special Issue.

This Special Issue contains the 24 papers that survived peer review, and provides insight into the current state of psychophysiology in Australasia. It is interesting to note that, although geographically far from Europe and the US, we are not so isolated these days - the Special Issue includes papers based on ASP2012 presentations by members from Korea and Poland, as well as the expected number from Australia. This internationalisation of ASP reflects the increasing scientific linkages apparent around the globe, and fits well with the ongoing aims of the journal's parent body, the International Organization of Psychophysiology (IOP). Note that ASP formally affiliated with IOP in 2000.

Keywords

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Editorial

Psychophysiology in Australasia

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The idea of a Special Issue of the *International Journal of Psychophysiology* focusing on research “*down under*” emerged in 2012 from discussions between the Society President (Robert Barry), the journal Publisher (Shamus O’Reilly), and the Editor-in-Chief (Connie Duncan). It was greeted with enthusiasm by the Society Executive, who set up an Editorial Committee to progress the project, beginning with establishment of timelines, evaluations of the conference abstracts* accepted for presentation at the 2012 meeting of the *Australasian Society for Psychophysiology*, ASP2012, and critical scrutiny of each conference presentation. Formal invitations for selected authors to contribute to the Special Issue followed the conference. Members of the ASP Editorial Committee then served as Action Editors for the Special Issue.

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We begin the Special Issue with a section on heart rate variability (HRV) and its relationship to health and well-being. Heart Rate Variability is the beat-to-beat variability in the cardiac cycle over time. It is increasingly popular as an index of autonomic nervous system function in studies examining a wide variety of phenomena, such as emotional regulation and cardiovascular disease. Kemp and Quintana provide an overview of HRV, its relation to mental and physical health, and whether HRV reductions in patients with psychiatric symptoms (e.g., depression, anxiety, alcohol use disorders) predict future problematic outcomes such as cardiovascular disease. Based on the extant literature, including a great deal of the authors’ recent work, this review presents a model of how these various effects are organized in relation to each other and how they may potentially guide future research. The next paper by Heathers presents a novel and cost-effective approach to acquiring HRV data in naturalistic settings. The goal was to determine the efficacy of recording cardiovascular data using an optical pulse sensor attached to a smart phone, as an alternative to traditional laboratory recording methods. This work is likely to be of great interest to researchers looking for innovative ambulatory recording techniques. In the final paper in this section, Krygier and colleagues address an interesting topic in an under-explored field of research. Specifically, they test whether Vipassana meditation influences well-being and HRV, building on the social psychophysiological literature linking these two measures. Strengths of the paper include the use of multiple HRV measures, as well as a clear and straightforward introduction and review of the literature.

This Special Issue then shifts its focus to EEG studies. In the first of two papers on EEG in attention deficit/hyperactivity disorder (AD/HD), Clarke et al. use EEG and skin conductance level (SCL) to determine whether children with AD/HD who display an EEG profile that is atypical of the disorder (with *elevated* rather than *decreased* beta levels) have a hyperaroused central nervous system. The results of the atypical elevated-beta group provide no support for this hypothesis, with their SCL paralleling that in children with the typical AD/HD profile of excess theta/reduced beta. The results challenge the use of theta/beta ratio as a neurophysiological marker of arousal, and have important implications for clinical practice and current theorising on AD/HD. Building further on a long research line, Dupuy et al. explore sex differences in the EEG profiles of the major sub-types of AD/HD. Across sex, eyes-closed EEG findings replicated expected differences for AD/HD compared to controls, and also between the subtypes. But girls with AD/HD show disparate EEG profiles, strongly suggesting that future research should focus on sex-specific patient groups rather than assuming that they can be meaningfully combined. This could mark the beginning of a paradigm shift in work on this syndrome, and might well generalise to other disorders with gender imbalances, such as autistic spectrum disorders. Illuminating a truly twenty-first century disorder, Hwang et al. examine resting EEG activity, specifically beta and gamma, in individuals with Internet addiction, seeking to understand the electrophysiological correlates of this addictive behaviour. The results suggest an imbalance of inhibition-excitation in maintaining cortical homeostasis, with these characteristic "biomarkers" seen as having potential as measures of treatment efficacy. Turning to the elderly, Gola and colleagues report an interesting study examining beta power as an index of attention modulation in the anticipatory cue-target interval. They found that decreased occipital beta power was associated with worse performance in one elderly subgroup, with the opposite pattern in a better-performing subgroup, providing an important contribution to knowledge on age-related effects on performance/brain-activity relationships. In the final paper in this section, Bowley et al. examine changes in behaviour, implicit alcohol-related cognitions, and frontal EEG asymmetry following one of two inhibitory control conditions compared to a brief alcohol intervention. While they did not replicate prior evidence of the inhibitory control effect on behaviour, their results suggest an EEG effect of the inhibitory manipulation. This study is novel in its investigation of training effects on EEG asymmetry, and importantly advances the field through the use of this objective measure.

The next group of papers focuses on a range of experimental determinants of event-related potentials (ERPs). Smith and colleagues provide a novel analysis of the contribution of the contingent negative variation (CNV) to the P300 component following inconsistencies reported in previous research examining topographic variations between Go and NoGo P300s. The study provides the first comprehensive assessment of the influential early view that differences in the topography of the P300 to Go and NoGo stimuli in response inhibition tasks may be dependent on the choice of baseline. Magnuski and Gola aimed to clarify whether the N170 amplitude increase to inverted faces was explained by Itier's eye-selectivity model (Itier et al., 2007). This study compares faces, faces without eyes, cars, and cars without lights, at various rotations including inversion. Rather than fitting Itier's model, the data led them to an interesting integrative model of N170 amplitude in face processing. The last paper in this section explores aspects of Barry's (2006) Preliminary Process Theory (PPT) of Orienting Reflex (OR) elicitation, seeking to add ERP aspects to the autonomic fractionation underlying the theory. In this paper, Barry et al. examine stimulus intensity and novelty effects in a number of autonomic measures and single-trial ERP components. The results show clear evidence that putative measures of the OR are differentially sensitive to

stimulus intensity and repetition, replicating some prior research and providing new ERP evidence of the different stimulus-response patterns in PPT.

Event-related potentials (ERPs) also offer a temporally sensitive and unique means of investigating neural activity associated with typical and atypical cognition in clinical and healthy populations. The first paper in this section of the Special Issue, by Bruggemann et al., examines mismatch negativity (MMN) in children presenting with putative antecedents of schizophrenia. Unlike the extant literature in adults with schizophrenia and other at-risk groups, Bruggemann et al. report increased MMN amplitude in these at risk children, and argue that this may be a result of maturational and disease processes. The P50 component has also been investigated as a risk marker for schizophrenia, and Broyd et al. next examine P50 as an index of sensory gating in regular cannabis users, exploring a potential association with the development of psychotic-like symptoms. Although an association with psychotic-like symptoms was not identified in this sample, prolonged exposure to regular cannabis use was associated with greater impairments in P50 indices of sensory gating. Given the relatively few papers examining sensory gating in cannabis users, this adds important knowledge to the field, and highlights similarities (and possible common underlying pathologies) between schizophrenia and chronic cannabis use. The paper by Lole et al. also draws our attention to the application of innovative analysis techniques to elucidate the link between neural processes and related cognition. Lole and colleagues used spatiotemporal principal components analysis (PCA) to clarify current conceptualisations of reinforcement processing during an ecologically-valid electronic gaming machine task. They identified two distinct ERP components within the latency range of the feedback-related negativity (FRN), and found one of these, the feedback-related positivity (FRP), to be more sensitive to reward valence. The authors suggest that these findings may be applied in future work examining problem gambling behaviours. Finally, the paper by Steiner et al. explores the link between working memory capacity and target-to-target interval (TTI) effects on the P300. Like Lole et al., they also used PCA to tease apart the independent and overlapping ERP components in this latency range. They report greater changes in one P300 component, P3b, with increasing TTI in individuals with better working memory, consistent with the authors' template-update theory of P300. This study significantly advances current conceptualisation of the P300, and links it with updating in working memory.

The next group of papers explores aspects of the interrelations between ongoing EEG and the ERPs generated in various paradigms, probing the fundamentals of cortical dynamics. Boonstra and colleagues present a novel study testing a recent model of ERP genesis based on the contribution of non-symmetric brain oscillations to slow potentials. They report specific co-variation between theta and alpha activity and different ERP components throughout the stages of a visual working memory task. The paper also encourages the use of partial least squares multivariate analysis and provides a rigorous assessment of the electrogenesis of slow cortical potentials. Work by Budd and Timora systematically manipulates amplitude modulation rate for auditory and vibrotactile stimulation to determine the impact of cross-modal temporal correspondence on the EEG steady state response. Using a time-frequency analysis, the authors find no evidence that EEG steady state activity at the frequencies corresponding to the modulation rate (i.e., EEG entrainment) was consistent with multisensory integration of cross modal temporal information. The authors discuss their results in terms of current views regarding cortical oscillatory mechanisms underlying multisensory processing and make suggestions for future research. In a companion paper, Timora and Budd use a more traditional FFT analysis to examine whether the EEG steady state responses to variations in cross-modal correspondence of acoustic and vibrotactile

amplitude modulation are reflected in psychophysical measures of amplitude modulation detection. The authors report marked differences between EEG and psychophysical measures of cross-modal temporal correspondence, suggesting that these measures reflect distinct mechanisms. These results counter the common assumption that entrained EEG activity reflects sensory processing of the temporal characteristics of stimulation, and the authors discuss this in terms of future research. The final study in this section, by De Blasio et al., examines the contribution of prestimulus EEG to ERP responses under both passive and active task conditions in a habituation task, looking for similarities with their previous studies of cortical dynamics in the Go/NoGo paradigm. The authors report a complex pattern of results in which the contribution of prestimulus EEG differs as a function of EEG frequency band, task and ERP component. The results are interpreted in terms of confirmation of important links between prestimulus EEG amplitudes and ERP component amplitudes, although moderated by the influence of task design, instructions, and analytic techniques.

The final group of studies examines different aspects of physiological indices of arousal and affective processing. Macefield and colleagues review recent research on concurrent microelectrode recordings of muscle sympathetic nerve activity (MSNA) or skin sympathetic nerve activity (SSNA) and fMRI of the brain. They aim to identify areas in the brain responsible for generating increases in sympathetic outflow at rest and during emotional engagement. The systematic methodology adopted throughout this research highlights the importance of the authors' approach, examining specific disorders of emotion perception in order to increase understanding of the neural processes involved. The following two papers by Rushby and colleagues provide novel insights into arousal dysregulation following severe traumatic brain injury (TBI). In the first of these, the authors elucidate the neural and autonomic correlates during a simple eyes-open and eyes-closed resting task. As the first paper examining alpha power in severe TBI patients, the findings represent an important advance in the field, suggesting that alpha power may provide a sensitive index of impaired arousal in TBI, with important clinical implications. For their second paper, Rushby et al. investigate the relationship between empathy deficits and psychophysiological responsivity. Significantly, the observed alterations in arousal may show some normalisation following repeated exposure to emotional stimulation, which has clear implications for remediation and therapeutic interventions in TBI. In a very different population, the paper by Mathersul et al. examines whether high-functioning adults with autism spectrum disorders (ASDs) may be separated into subgroups based on differences in resting arousal (SCL). A subgroup of ASD adults with significantly lower resting SCL demonstrated poorer emotion recognition, tended to judge faces more negatively, and had atypical relationships between SCL and affective empathy. Insight gained from this research provides a potential explanation for the inconsistencies in the literature with respect to social cognitive abilities in ASD. Finally, Iredale et al. utilise ERPs to examine the Schirmer and Kotz (2006) model of vocal emotion perception. They examine happy, angry and neutral vocal utterances, while controlling for semantic content, and focus on successive processing stages reflected by the N1, P2, and N3 ERP components. This exploratory study provides support for an advanced neural model of emotional prosody perception that should prove useful in future research.

These 24 papers provide an excellent overview of the exciting research in psychophysiology currently occurring "*down under*". They cover a wide range of interests, research foci, and methodologies, and it is hoped that the research showcased here will have a lasting impact in our field. In bringing this collection together, the Editorial team has worked collaboratively and enjoyed the exercise. We owe special thanks to Shamus O'Reilly and Connie Duncan for their support of the project, the Elsevier team for assistance with the intricacies of "the

system”, the reviewers for their constructive comments on the manuscripts (sometimes through several revision stages), and especially the authors for their contributions.

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Footnote

*The abstracts of the keynote addresses, and accepted oral presentations and posters for ASP2012, are attached to the electronic version of this Editorial as [ASP2012 abstracts.pdf](#). Further information can be obtained at the *Australasian Society for Psychophysiology* website, <http://www.asp.org.au/>.

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