

Use of Event-Related Potentials in the Study of Typical and Atypical Development

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ABSTRACT

A variety of neuroimaging tools are now available for use in studying neurodevelopment. In this article, we focus our attention on one such tool—the event-related potential (ERP). We begin by providing an overview of what ERPs are, their physiological basis, how they are recorded, and some constraints on their use. We then provide an abbreviated glossary of ERP components, that is, what processes are reflected in ERPs. We conclude by summarizing two areas of atypical development that have benefited from this method: children experiencing early psychosocial neglect, and children diagnosed with autism. We conclude by offering recommendations for future research. *J. Am. Acad. Child Adolesc. Psychiatry*, 2008;47(11):1253–1262. **Key Words:** ERP, autism, brain development, faces.

In 1997, Nelson and Bloom lamented the paucity of research elucidating the neural bases of behavioral development. For the ensuing 10+ years, the field of developmental cognitive neuroscience has gained considerable traction, with entire single-authored^{1,2} and edited volumes^{3–5} dedicated to this field, along with special issues of journals (e.g., *Journal of Cognitive Neuroscience*, *Neuropsychologia: Developmental Review*). Among the many reasons for the progression of this field has been the advances made in neuroimaging. Specifically, the refinement of existing tools (e.g., event-related potentials [ERPs], functional magnetic resonance imaging) and the development of new tools (e.g., functional near infrared spectroscopy) have now made possible

the ability to examine the neural correlates of cognitive and emotional development.

In this article, we focus our attention on one particular tool—the recording of the ERP. The ERP reflects the brain's electrical activity recorded from electrodes placed on the scalp surface and can be used across the entire life span, thereby permitting one to use the same methodological tool and dependent measure across a broad range of ages.

WHAT IS THE ERP?

Event-related potentials represent the synchronous activation of electrical fields associated with the activity of large populations of neurons. This activity volume conducts to the scalp surface and is configured in such a way that their individual electrical fields summate to yield a dipolar field (a field with positive and negative charges between which current flows).

Event-related potentials reflect changes in the brain's electrical activity in response to a discrete stimulus or event. They are typically collected during the presentation of stimuli that repeat many times. Recording generally begins 100 or more milliseconds before a stimulus is presented and then continues for 500 to 2,000 milliseconds after the stimulus has terminated. Each “trial” or epoch is generally averaged to eliminate background noise that is not related to the stimulus of interest. As a result of averaging, the noise theoretically

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