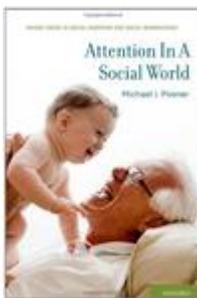# Paying Attention to Michael Posner

A review of

Attention in a Social World

by Michael I. Posner

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Michael Posner is one of the founders of the field known today as the cognitive neuroscience of attention. One of the oldest and most critical topics in the field of psychology, *attention* refers to both the preparedness for and selection of certain aspects of our physical environment (e.g., objects) or some ideas in our memory. An insightful model suggested by Posner construes attention as a collection of autonomous control modules. This theory, proposed over four decades ago, challenged the monolithic view, which until that time regarded attention as a largely uniform concept and replaced it by the notion of independent brain networks (Raz & Buhle, 2006).

These separate control modules, Posner argued, drew on discrete neural circuitry. Moreover, Posner and others have since shown that focal brain injuries, mental states, and specific drugs influence at least three key functionally and anatomically distinct types of

attention: alerting, orienting, and executing. This brain network approach may seem intuitive now, but it far predated imaging of the living human brain. Over the years and with the cumulative guidance of converging data, Posner has revised his original model while retaining its tenor.

Attention in a Social World is Posner's latest popular exposition on the psychology of attention. The recipient of many prestigious awards and accolades, Posner has authored hundreds of scientific papers in some of the best peer-reviewed journals. In addition, Posner has contributed several books as editor, author, and coauthor: for example, *Chronometric Explorations of Mind* (Posner, 1986), *Images of Mind* (Posner & Raichle, 1994), *Educating the Human Brain* (Posner & Rothbart, 2007; reviewed in *PsycCRITIQUES* [Schlaggar, 2007]), and *Cognitive Neuroscience of Attention* (Posner, 2012). In the present book, Posner reaffirms that attention is a central theme in cognitive science, linking brain with behavior and yoking psychology to the techniques of neuroscience.

Although modern psychology has probably examined the topic of attention more than any other, Posner introduces attention in a larger social context that extends beyond laboratory experiments, providing innovative applications to education, treatment of psychopathologies, and computer training programs. By defining *attention* as the orchestration of three separate networks, he consolidates behavioral, imaging, and genetic findings into a coherent whole. Moreover, he discusses individual differences in attention—a field he has championed for many years—and outlines the role that upbringing, environment, and early experiences wield on the development of attention networks. Spanning genes, social factors, and functional anatomy, Posner provides the reader with a lucid narrative of modern attention.

Posner views attention as an organ system with its own functional anatomy, circuitry, and cellular structure. This approach promises to sketch out the evolutionary and developmental basis of a principle brain mechanism of voluntary control, thus paving the road toward an understanding of how genetics and culture shape control systems. Posner was one of the first scientists to propose that by studying the unique neurobiological and functional characteristics of each network, researchers can systematically search for genetic variations—that is, polymorphisms—associated with differences in the regulation of cognition, thought, emotion, and action.

The mapping of the human genome offers the potential for an increased understanding of how biology and environment interact to produce individual differences, for example in temperament. Many genes exhibit variations that code for different phenotypes, which in turn can alter the efficiency of a network. The dopamine D4 receptor gene (DRD4), for example, has several versions that differ in having two, four, or seven repeats of a portion of the gene, and it correlates with attention-deficit/hyperactivity disorder (ADHD) and sensation seeking.

Posner and his colleagues found that in the presence of the seven-repeat variant, parenting had a significant effect on an array of temperamental dimensions that

corresponded to the symptoms found in children with ADHD (Sheese, Voelker, Rothbart, & Posner, 2007). Children with the seven-repeat allele who had a lower quality of parenting had unusually high levels of sensation seeking, including impulsivity. By identifying children who are more susceptible to environmental factors, Posner shows how we can determine which children will benefit most from therapies that aim to improve attention.

As in his other work, in *Attention in a Social World* Posner sketches out a disciplined way of elucidating the biological substrates of attention and their relation to social science. He hints at the impact that genetic variation holds for attention through the association of each network with different neuromodulators.

For example, experimental studies examining spatial orienting suggest that anxious people orient toward negative and positive targets in a similar manner, but highly anxious individuals have trouble disengaging from the negative target when the cue is invalid. These findings complement data from recent studies showing a negative correlation between negative affect and effortful control (e.g., Rothbart, 2011). Before long, therefore, clinicians may consider using attention training as a strategy to bolster executive attention for patients to more easily disengage from negative ideation.

The "Posnerian trinity" (i.e., three-network model) provides researchers with the tools to properly examine optimal school curriculums, rehabilitation programs, and even parenting styles. By construing attention as an organ system, Posner focuses on its functional connectivity, neuroanatomy, electrochemical dynamics, and cellular structure. His integrative approach goes beyond inspiring researchers of attention; it leads the way to an interdisciplinary approach unifying the social, life, and computational sciences. For those familiar with Posner's instrumental contributions, this little book may be "old news," but this volume makes his revolutionary ideas and trailblazing science available to a wide and uninitiated readership.

Looking into the past and projecting into the future, one may conclude that attention networks seem to have captured a central place in psychological science. Whereas half a century ago researchers largely focused on demonstrating that attention changes specific operations in the information-processing hierarchy from input all the way to behavioral outcome, since the 1990s the advent of neuroimaging has increasingly elucidated the focal brain areas that subserve these attention networks.

Nowadays, moreover, investigators study the brain modules that operationalize the computations performed by attention and monitor their patterns and rhythmic activations in real time. Present since early childhood, attention networks evolve through the life span and into adulthood via changes in connectivity. The combinatorial explosion that typifies the many possible configurations of genetic polymorphisms, alongside their interaction with the environment, gives rise to individual differences in the efficiency of the control networks that compose attention.

Because recent findings show that practice may improve the operation of specific attention networks by altering overarching brain states, future studies will likely further

unravel the development of these networks, identify individual impairments, and forge new methods to ameliorate such deficiencies and enhance performance. Posner's exposition presents a delightful read and provides important insights and experimental sensibilities that many curious minds would appreciate. We recommend this book wholeheartedly.

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