

# Preface

US psychiatry is in crisis. Perhaps the most evident symptom is the ‘trans-institutionalization’ of those with serious mental illness (SMI) from hospitals to jails and prisons, following decades of psychiatric bed eliminations. For New York State, some 96,000 such beds were available in the mid-1950s. About 3000 remain. New York City’s Rikers Island jail houses some 11,000 inmates, with about 4000 now diagnosed as suffering SMI. Statewide, approximately 60% of hospital beds in jails and prisons are occupied by those with SMI. Current policy initiatives focus on making this mass jailing of the mentally ill ‘more humane’. The pattern is repeated nationally. As Bastimpillai et al. (2016) note:

Currently, the United States has a relatively low 22 psychiatric beds per 100,000 population compared with the Organisation for Economic Cooperation and Development (OECD) average of 71 beds per 100,000 population. Only 4 of the 35 OECD countries (Italy, Chile, Turkey, and Mexico) have fewer psychiatric beds per 100,000 population than the United States... Germany, Switzerland, and France have 127, 91, and 87 psychiatric beds per 100,000 population, respectively.  
(Bastiampillai, T., S. Sharfstein, S. Allison, 2016, US suicide rates and the critical decline in psychiatric beds, JAMA, doi: 10.1001/jama.2016.16989)

Further, the pharmaceutical industry has largely abandoned attempts to develop new drugs for SMI, beyond some continuing work on supposedly ‘organic’ dementias such as Alzheimer’s disease, which are themselves highly stratified at the population level according to education, income and social status.

Intellectually, mainstream psychiatric doctrine exceeds even the discredited neoliberal atomism of mainstream economics, committing the mereological fallacy of attributing to ‘the brain’ what are complex disorders of not merely the entire individual but the individual enmeshed in both culture and an environment that, for humans, involves mostly other humans and their institutions.

Indeed, this latter circumstance has not gone entirely unremarked. As Huys et al. (2016) put it:

...[M]ental health depends not only on the function of the brain...but also on how that function relates to, influences, and is influenced by the individual’s environmental and

experiential challenges. Understanding mental health, and its disruption, therefore relies on linking multiple interacting levels, from molecules to cells, circuits, cognition, behavior, and the physical and social environment.

(Huys, Q., T. Maia, M. Frank, 2016, Computational psychiatry as a bridge from neuroscience to clinical applications, *Nature Neuroscience*, 19: 404–413)

But, although there are many attempts in the literature to mathematically model neural process and, in some measure, its dysfunction, for ideological reasons, there is little actually available that places mental function within sociocultural, socioeconomic and environmental context. What does exist is widely scattered, both as peer-reviewed papers and individual chapters. This book brings the author's work in this direction into a single place and significantly extends it.

One central point is that a large class of cognitive processes can be approximated in terms of information sources. This is because cognition involves active choice of a response to impinging signals from a larger set of available alternatives. Choice reduces uncertainty, in a formal manner, and reduction in uncertainty implies the existence of an information source that we take as 'dual' to the cognitive process. The asymptotic limit theorems of information and control theories then impose themselves, allowing construction of necessary conditions statistical models, roughly as the central limit theorem allows construction of least squares regression models. While statistics is not science, statistical models permit comparison of similar systems under different conditions and different systems under similar conditions. To understate the case, iterating such comparisons can be of great use in refining scientific inference based on observational or empirical data.

A second central point is that, taking the perspective of Bennett and Feynman, in spite of its mathematical form, information is not an entropy, but a kind of free energy. Indeed, it is easy to construct an elegant little ideal machine that converts the information within a message to useful work. It then becomes possible to construct dynamic statistical models akin to Onsager's treatment of nonequilibrium thermodynamics, albeit without 'reciprocity relations' since most information sources are not even locally reversible: palindromes are very rare.

The first chapter examines the primary mental experience—consciousness—from an evolutionary perspective, recognizing the ubiquitous role played by the exaptation of crosstalk between cognitive modules at many different scales and levels of organization, in an explosion of parallel traits very similar to such examples as the many different forms of wings for flight.

Chapter 2 explores the missing heritability of complex diseases, focusing on 'cultural epigenetics' as essential contributing 'dark matter', while Chapter 3 makes the case that all forms of SMI are—necessarily and inherently—'culture-bound syndromes'. Chapter 4 introduces control theory tools to explore the environmental induction of neurodevelopmental disorders, in a large sense, and Chapter 5 continues with a study of the synergism between culture, psychopathology and sleep disorders.

Chapter 6 reexamines function and dysfunction from the perspective of embodiment. Chapter 7 introduces 'hidden symmetry' methods that should be useful in

future studies of this nature. Chapters 8 and 9 use perspectives developed from computational psychiatry to examine failure modes of autonomous vehicle and autonomous/centaur weapon systems, emerging as de facto ‘psychopathologies’ of automata. Chapter 10 applies approaches from evolutionary economics to the self-referential dynamics of environmental insult, finding ratchet dynamics that can trigger increase or decline in factors producing developmental and cognitive dysfunction. The final chapter examines ‘the madness of crowds’ from the perspective of recent US security doctrine.

The chapters can be read separately according to interest; hence there is some considerable repetition of methodology between them, but many mathematical details have been collected into a general appendix.

Contrary, perhaps, to current expectations, it appears that the level of mathematics needed to address cognitive function and dysfunction in full context rivals, and likely exceeds, the norms of general relativity, high-energy particle physics, theoretical chemistry, and string theory.

### **About the Author**

Rodrick Wallace has an undergraduate degree in mathematics and a Ph.D. in physics from Columbia University. He completed postdoctoral training in the epidemiology of mental disorders at Rutgers University and is a research scientist in the Division of Epidemiology of the New York State Psychiatric Institute. A past recipient of an Investigator Award in Health Policy Research from the Robert Wood Johnson Foundation, he is a former public interest lobbyist and the author of numerous peer-reviewed papers and books across a variety of disciplines. His work specializes in understanding the roles of state policy, historical trajectory, culture and socioeconomic structure in determining patterns of public health and order.

### **Two poems by Alfonz Wallace**

#### **WARNING**

Look into his mind, and then  
Never dare to look again;  
For, in all that we might see,  
There is much of you and me.

#### **BLACK NARCISSUS**

Of all night’s strange inhabitants,  
The creature I fear worst  
Never betrays the countenance  
That makes my sleep accursed.

I flee and search, finding no place  
His dark shape will not find,  
Who lives in my own body’s space  
And borrows my own mind.

Computational Psychiatry

A Systems Biology Approach to the Epigenetics of  
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