Research Statement

Dynamical systems theory is an interdisciplinary approach to understanding what happens when many individual units interact through time. At its simplest, systems theory is merely a study of change and coordination, drawing from mathematical knowledge of how nonlinear relationships function. Systems theory postulates a very different series of assumptions than those commonly embraced in psychological research. They are anti-reductionist in that causality becomes both very tricky and less useful. Nonetheless, I believe that many of the current theories in psychology closely parallel systems thinking. For example, we often talk about feedback loops, and how couples and groups function differently than individuals in ways that are consistent with the systems concept of self-organization - when individual units interact they can form gestalt behaviors not visible within any unit on its own. If true, then the problems with causality are a byproduct suggesting that our current approaches seek unattainable information. Systems theory provides an alternate way forward to conduct science using methods that are both consistent with our theories and what can and cannot be learned about phenomena in the social sciences.

At a SPSP pre-conference on dynamical systems theory in 2012 Robin Vallacher, Stephen Read, and Andrej Nowak expressed disappointment and confusion as to the fact that so little of psychology had embraced systems theory 20 years after their seminal book on systems based social psychology. The way theorists talked about phenomena mapped onto systems theory almost perfectly. Yet few even knew about the ideas and those who did expressed them as too complicated. This set a new goal for my career – bringing systems theory into the mainstream.

To change a field, it becomes necessary to make the ideas approachable and exciting. This is no small feat. Systems theory has accrued 200 years of jargon from dozens of different fields. Some of the jargon conflicts and the connections to concepts are sometimes fuzzy leading to messy definitions, translations, and an inability to be able to understand what is gained, lost, and assumed when embracing a dynamical systems approach. Further, major advancements in systems theory have occurred with the advent of fast computing that make statistical approaches in systems theory even more distal from non-systems statistics. This is only increasing the divide. My current work is designed to be bridge across the chasm. I have sought to explain systems concepts capitalizing on grade school concepts such as how to read a map (the math is the same). I have sought to directly link the concepts to our understanding of statistics by showing how analyses in regression can be systems analyses. I have sought to make our assumptions clear so that we can understand what is gained by using a systems approach.

Simultaneously, I have sought to create exemplars across many fields through a team science approach. I bring my systems thinking and statistical knowhow while my colleagues bring understanding of a specific phenomenon that I could never achieve. Together we generate systems research exemplars in which theory, concept, and statistics all align. Cindy Berg and I have done this for years involving families and diabetes. However, I have also done so involving NASA program managers to understand budget overruns, understanding menopause, physiology, and motivation (this list is far from complete). My most recent grant (I am an MPI) involves one such project applying systems theory to digital phenotyping and eating disorders.

Lastly, I continue to innovate systems-based analytic techniques. As these projects generate excitement, they also generate new problems. How does measurement and systems theory integrate? Recently, I have gone to the literature on differential topology to address this very question (under review at Psychological Methods). This is probably the single most important topic I have researched as it ends up being a gateway to completely rethinking measurement that integrates all my work on coordination while also providing a framework for thinking about dimensionality, reliability, scale creation and an integrative approach to modern systems analysis. It suggests a functional approach to measurement that we often discuss but rarely embrace.

It is easy to look at my vitae and see a team scientist who functions primarily as a collaborator. However, I truly embrace the notion of the transdisciplinary researcher. Though I can be described as a psychologist due to my training, there are a half dozen other descriptions that would fit just as well. Psychology is one of the most complex phenomena. So, let’s challenge ourselves.