Research Statement

My research derives directly from Dynamical Systems Theory – 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. 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. This self-organization often results in unique temporal signatures that can be fairly stable and parallel the qualitative descriptions we use to capture psychology. Examples of applying these connections between systems concepts and the qualitative distinctions from psychology can be found in some of my earliest work on integrating dynamical systems theory with evolutionary theory (Kenrick, Li, & Butner, 2000 & 2003; Kenrick, Maner, Butner, Li, Becker, & Schaller, 2002), my struggles with dyadic regulatory processes (Butner, Diamond, & Hicks, 2007), and even work on visual form perception (Malloy, Butner, & Jenson, 2008).

As psychologists rely on classic assumptions, we commonly utilize methodologies and statistical theory not designed for a dynamical systems world. My research thus often involves quantitative innovations particularly designed for dynamical systems in the face of psychological data constraints (e.g. restrictions on the amount of data and arbitrary metrics with measurement error) usually within Structural Equation Modeling or Multilevel Modeling. My work on coupled oscillatory processes (Butner, Amazeen, & Mulvey, 2005; Butner, Berg, Baucom, & Wiebe, In Press; Butner, Diamond, & Hicks, 2007; Finan, Hessler, Amazeen, Butner, Zautra, & Tennen, 2010; Butner & Story, 2010) and fractal structures (Butner, Pasupathi, & Vallejos, 2008; Butner, Story, Berg, & Wiebe, 2011) exemplify these quantitative innovations.

However, most of the time, I focus on both theory and quantitative innovation simultaneously. One of my most recent examples of this is through my grant with NASA to attempt to predict their budget overruns (an attempt to apply systems theory to larger interdisciplinary issues). In a recently accepted paper (Butner, Dyer, Malloy, & Kranz, In Press) we extrapolate a systems model from the qualitative analysis of NASA’s management system and show that the resultant model (which requires innovations of catastrophe model testing through multilevel modeling) is able to account for a third of all variability in the budget including potential for overruns. The recently funded continuation of our grant involves a longitudinal examination of managers to integrate their changing perceptions over time to the model hopefully identifying what aspects of overrun warning signs to which they are and are not sensitive.

A second example comes from my ongoing collaborative grant work from NIH and NIDDK with Cynthia Berg and Deborah Wiebe on diabetes management in a family
context. This chronic regulatory scenario requires the coordination of multiple family members and even multiple psychological aspects within each family member. To address this multivariate scenario I recently published how to modify latent change score models to produce results that can be interpreted within classic coordination logic (Butner, Berg, Baucom, & Wiebe, In Press). We utilized this technique to examine diabetes regulation aspects both within adolescents with diabetes and between their parents simultaneously, assessing the number of unique coordinative processes. Our continued collaboration has recently resulted in the formation of an interdisciplinary consortium at the University of Utah committed to examining health impacts within the context of families while taking a systems perspective. Our plan is to elevate the consortium to an interdisciplinary research center at the University in the near future.

Taking a systems approach to research is complicated and I (and others) have unintentionally marginalized systems theory through the sheer complexity we bring to psychology. This realization has begun to feed into my new research. My goals as I move forward over the next few years are to continue to argue that psychology is systems theory and to continue to innovate quantitative approaches as I need them. But, I am also providing easier tools and language to help others make this transition. As an example, I have a recently accepted in Psychological Methods (Butner, Gagnon, Geuss, Lessard, & Story, In Press) showing how merely treating a difference score as the outcome in a regression or multilevel model can have vast implications and that systems theory implies specific ways to theorize and explore these models. This is a theory driven approach to systems research. Additionally, I am writing a paper on topography through mixture modeling as an easy entry point into systems theory with nonlinear models – an exploratory approach. In this new piece that I hope to submit to Psychological Review (and have given talks on the topic at various conferences) I show how mixture modeling of certain forms of change as outcome models extracts various topographical features that have relatively easy interpretation. These results can then be used to further explore the phenomenon. The paper unites results from three different circumstances implying new interventions for sleep problems, limitations of our knowledge on regulation in online learning, and where behavioral self-control functions as a higher order moderator but also fails in moderating inevitable and extreme diabetes regulatory problems.

As a final note, my vita is also filled with many other publications. As one of the primary quantitative individuals in the department, part of my job is to consult on other faculty and student projects. I take this role seriously, and provide assistance, as needed even when it deviates from a dynamical systems perspective. I see this work as an integral part of my identity as a quantitative psychologist, but not necessarily contributing to my interests in systems theory. My favorite moments in my career are when these side projects change into systems ones as I hope (and believe) that we will all be systems theorists in the future.