

PART VI

MIXED METHODS AND COMPLEX ANALOGIES

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The final section of this book puts emphasis on combinations of methods—synthetic analysis—rather than focusing on any given approach on its own. The five chapters here explore complex phenomena through a range of methods, each complementing the others in a holistic examination of the system/phenomenon.

I begin with Goldstein's work, based on his long-standing influence in creating a discipline of complexity (Goldstein 1988, 1999, 2000; Goldstein, Hazy and Silberstang 2010). His work is also the most theoretically broad in this section, as reflected in his main research question: 'How can we best conceptualize, and therefore measure, the nature of emergence itself, in our world?' His primary claim is that we often see emergence in the wrong way, as an outcome derived ('self-organized') by a recombination of existing elements. Instead, emergence should be seen as the creation of something 'radically novel.' Whereas in self-organization the components stay the same but are re-ordered, in radical novelty the micro elements themselves transform, leading potentially to new types and levels of macro order, and sometimes to new laws and processes within the system.

To study this emergence requires first considering the many different ways these macro-phenomena may appear in emergence, and then seeking to identify at least one data collection/analysis method for each. These may be quantitative—he talks about dissipative structures, cybernetics, physics and mathematics (Cantor sets). They may be qualitative—he includes Goethe's *alternative qualitative methods*, and uses case studies as examples. They may be actionable, as he illustrates through the creative arts, and his own approaches of *difference questioning* and *purpose contrasting* for enacting social change. Mostly, these need to be synthesized, brought together into a shared view (story) about the complex phenomenon. Overall, Goldstein's emphasis is in exploring methods that can identify the radical nature of emergent, 'self-transforming constructions.'

Varga's chapter pushes this theme in a more operational direction, identifying various complexity methods and approaches that can be used to "integrate across scales and boundaries." Here again, the goal is to synthesize information, to gain the clearest understanding of the complex systems being studied. But she reminds us that integration is challenging, requiring carefully designed strategies of data collection and analysis.

The core of her chapter is a detailed introduction of ten specific methods/designs and seven paradigmatic stances that researchers can use to explore complex systems. Each

of these approaches is valuable for seeing or enacting a specific quality of emergence. In addition, she provides remarkable detail on a panoply of data collection techniques and research methods, which span qualitative/quantitative, computational, historical, and more. Likewise, she provides strategies for dealing with the inevitable challenges that such complicated research designs can face. Finally, she presents a 3 x 3 matrix of data collection and analysis techniques, which reveal the potential of multi-method designs in complexity studies. In sum, Varga offers a kind of complexity methods road map, with strategic advice for how best to collect and analyze wide-ranging data on complex systems.

Drawing on the theme of complexity as a set of methods, Lichtenstein's chapter argues that complexity is really a combination of 15 sciences, each one a distinct disciplinary approach for identifying and understanding complex systems. Examples include NK landscapes, dissipative structures, cybernetics, power laws, fractals, multi-agent models, and ecosystem resilience. Each of these examines emergence in a unique way, by invoking a certain kind of research question, collecting a distinct type of data, and utilizing a novel analytic method to pursue the research. The bulk of the chapter is a brief introduction into each of these sciences, and the stream of studies that have used them.

The chapter also examines three main avenues for pursuing complexity research on emergence. The first, computational and mathematical models, is well-known through the work of scientists at the Santa Fe Institute (for example, Kauffman 1993; Holland 1998) and many parallel centers of simulation-based complexity studies. Unfortunately, some people think that simulations *are* complexity science, as opposed to one of its categories. However, although computational methods are good at answering certain types of questions, they are limited in exploring social systems in situ. Second are ideographic analogies to specific sciences (Tsoukas 1989; 1993), including dissipative structures, autocatalysis, and ecological resilience. Here, a careful mapping between a theory of natural systems and a particular social situation can reveal how causal processes in the former may be reflected in the unfolding of the latter. Finally, a third category is narrative and multi-method designs, which are best used to show instances of emergence as they are happening. Garud and his colleagues (Garud and Giuliani 2013; Garud, Gehman, and Giuliani 2014; Garud et al. 2015) have mastered these approaches, generating great insight into the nature and dynamics of emergence. In sum, Lichtenstein's chapter furthers the road map idea, presenting a diverse set of methods that are used by complexity scientists.

Andriani and Carignani focus on methods that are based on strong ideographic analogies, mainly to the evolutionary concept of *modular exaptation*. Exaptation occurs when a trait or technology is applied in a different context to accomplish a new function or generate new modalities for which it was not designed. Often this yields radical improvements in the new system/context. A bulk of their chapter examines how to make ideographic analogies valid, avoiding the problem of sloppy metaphors. Specifically, they clarify the connections between the base theory of exaptation and the target of technology innovation, and show how to make convincing analogies through the method of structure-mapping (Gentner 1983).

Their chapter offers two contributions to complexity methods. First, the authors identify modular exaptation as a powerful driver of innovation, and show how it can be used to explain some of the most radical innovations in our time. In particular it allows us to track the emergence of entirely new product categories, in contrast to the incremental

improvements shown in traditional studies of organizational evolution. Second, they introduce *ideographic analogy* as a powerful analytic tool for exploring complex systems. The detail they provide is extremely useful for any complexity researcher who draws on scientific theories to explain complex social systems.

The last chapter in this section, by Shapiro and Scott, uses ideographic analogy as the basis for a new method called Dynamical Systems Therapy, which is dedicated to the practice of psychotherapy rather than research on complex systems per se. DST, the psychotherapeutic relationship is seen as a *complex adaptive system* that incorporates multiple interactive levels, including neurons and hormones, subjectivity (perception, feeling, intentionality), and inter-subjectivity. In contrast to the traditional psychiatric view of patients with diseases that needs to be fixed, DST views a patient's symptoms as 'breakdowns of adaptation,' and the therapy as a means for bringing more control to patients themselves. This psychobiological model expands the range of interventions to include psychopharmacology, psychodynamics, and cognitive-behavioral changes, all of which improve the chances of transforming the current system into one that's more adaptive and appropriate.

Of all the chapters in this section, Shapiro and Scott's is the most applied, focusing specifically on the practice of psychotherapy. The chapter exemplifies its key points through excerpts from actual therapy sessions. These reveal the skillful application of DST that clearly open up new cognitive territory for patients. The method is also explained through an analogy to *adaptive landscapes*, which shows how individuals can move away from rigid habits into new ways of feeling, thinking and acting. Likewise, they show how therapists can expand their understanding of the process, especially in how "the therapist's and the patient's systems interpenetrate and co-evolve together. . ." In this way it is truly a 'mixed' method, as it incorporates biochemical, emotional, behavioral and interpersonal realms, while bringing the practitioner directly into the focal system.

As a group, these chapters present complexity science in an expanded way, including a spectrum of approaches that include and transcend most common notions of complex systems. Their phenomenological foundations make them especially useful in practice, in understanding, as well as creating/enhancing emerging situations.

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