CHAPTER 2: PHILOSOPHICAL AND SCIENTIFIC CONTEXT OF THE STUDY

This aim of this study is to clarify what a natural system view of human behavior would look like and how this view is or is not accounted for in mainstream paradigms of psychology. Logically, a comparison of the first assumptions of VT with this natural systems paradigm requires a sufficient description of that natural systems paradigm. It may be simple enough to say that the natural systems paradigm is one which studies natural systems, and that a natural system is simply a system that occurs in nature. However, in practice it may actually be quite difficult to adopt and maintain a mode of thinking that is line with the natural systems paradigm. This may be difficult because the differences between natural systems thinking and conventional thinking may be subtle and difficult to describe (Bowen, 1980). One aim of this study is to improve on existing distinctions between these two modes of thinking in the literature.

This purpose of this chapter is to triangulate on what a natural systems view of human behavior might look like. First, the reductionistic paradigm of science and its limitations for problems of complexity will be reviewed. Second, the related problem of compartmentalization in science and in thinking about nature will be reviewed. Third, some challenges for psychology as a science of human behavior will be reviewed. Finally, the impact of these problems in science and psychology on the study of vipassanā meditation will be reviewed. Some speculation will be provided about ways that research on vipassanā meditation may be improved as it relates to this thesis.

The Problem of Complexity in Science and Responses to It

Kuhn (1962/2012) used the term *paradigm* to describe a collection of assumptions, or "club" (p. xxiv), or network of researchers who agree on those assumptions and use them to guide and communicate their research. From Descartes to Popper, the philosophical debate over paradigmatic assumptions that guide the study of nature has been boiling for centuries (Walsh et al., 2014). Guba and Lincoln (1994), in their *Handbook of Qualitative Research*, suggest that "paradigm issues are crucial; no inquirer . . . ought to go about the business of inquiry without being clear about just what paradigm informs and guides his or her approach" (p. 116). Yet at present, all that is commonly agreed on is that science is defined by the assumptions that define whatever paradigm the scientist builds their research upon (Kuhn, 1962/2012).

One important and popular assumption in science today is that which defines the *reductionist* paradigm (Laszlo, 1971; M'Pherson, 1974; Tuan, 2012; E. O. Wilson, 1998). The reductionist paradigm assumes that problems are best solved by dividing and dissecting pertinent variables to their essential and measurable components in order to determine the cause of the phenomenon in question. The strength in this view is that it makes simple what was once complex, makes clear what was once mysterious, and produces straightforward solutions to problems. The treatment of physical trauma in an emergency room, the correct nail to use for the frame of a housing structure, and the determination of wire gauge to compensate for a direct current voltage drop over long distances are all techniques which are made possible by reductionistic thinking. They tackle problems that have been solved with laborious and delicate analysis, and the resulting formulae produce predictable results specific to the problem domains from which they are derived (Gleick, 2011).

Reductionism has flourished as the paradigm of science since the industrial revolution and is responsible for the explosive growth in technical engineering that so visibly impacts the life of *Homo sapiens* today (Harari, 2015). As of this writing an estimated 62.9% of people in the world own a mobile phone (Statista Research Department, 2018, para. 2), a device so complex that it is impossible to tally the orders of magnitude above that which a single human mind can contain. This remarkable feat of engineering was accomplished through the innovative combination of small solutions to countless isolated problems such as battery storage capacity, computational power versus heat generation, sound quality over digital lines, wireless digital networking, GPS, camera quality, and, of course, transistor-based computational horsepower measured in billions of mathematical floating-point operations per second called *gigaflops* (and one day the unit will be 1,000,000,000,000,000 flops, or *petaflops*; Samarah & Fatmi, 2017). Each of these engineering problems was reduced to a manageable size in order to produce a deterministic solution with 99.9% or 100% accuracy, and the combined result is an non-living object so dynamic that its very creators cannot seem to find the limit of its novel uses (Terra & Passador, 2015).

Amidst the success, however, there remain problems which cannot be solved or even posed within the reductionist paradigm. These are problems of complexity. Reductionism assumes, or at least strives, for a quantitative worldview where discrete variables are used to create predictable solutions to problems (Khisty, 2006, Terra & Passador, 2015; Tuan, 2012). As any meteorologist who has tried to predict the weather or digital animator who has tried to model the movement of a human hair in the wind understands, predictability in nature is not linear nor unitized. There is evidence that problems of complexity behave more like an ocean of variable-particles flowing into each other simultaneously to produce results that cannot be easily quantified, let alone predicted (Gleick, 2011). A reductionist thinker faced with a problem of complexity may assert that all that is required is more computational power applied to an increasingly comprehensive dataset. It is possible, however, that problems of complexity cannot be accurately modeled at all, because the *period-buffer*, the computational version of a single frame in a motion-picture film, is a conceptual device imposed on nature through reductionistic thinking. It did not arise from nature itself. The trajectory and impact location of the proverbial cue ball determining the resulting vector and acceleration of a second billiard ball may be a great example for teaching the basic laws of physics to primary school students, but in nature countless particles interact with other particles simultaneously and without interval. Material and information flow in nature constantly and on an order of interdependence that no deterministic discrete model can capture, no matter how sophisticated (Sayama, 2015).

While reductionism works wonders in problems of engineering which can be reduced to simple causal rules like the elementary billiard table example, it can create problems of massive scale when it alone provides the dominant worldview (Bell & Morse, 2005). When assessment approaches to health care are founded on the assumptions of reductionism, they have the potential to ignore complexity. M. Kerr writes:

> A physician can repeatedly prescribe a diuretic for a patient with leg edema, but fail to recognize that the patient is in chronic heart failure. As a consequence, the edema keeps recurring. A psychiatrist can hospitalize a schizophrenic patient, but not appreciate how the problematic relationship between the patient and his parents has contributed to the hospitalization. The patient may improve and be discharged, but be rehospitalized a few months later. A family therapist may treat two parents and their schizophrenic son, but not attach importance to the fact that the parents are emotionally cut off from their families of origin. The parents' cut off from the past undermines their ability to stop focusing on their son's problems; once again, the therapy will be ineffective. (M. Kerr & Bowen, 1988, p. vii)

The type of thinking that assumes a single, essential solution to every problem will miss variables beyond the scope of the assessment framework used. This assumption also comes with a second and more fundamental implicit assumption, that each single effect has a single cause, a paradigmatic marker of 17th century mechanistic thinking (Godfrey-Smith, 2013; Hamdani, Jetha, & Norman, 2011; Puhakka, 2015). Russel's view of mechanistic,

> causal law is employed to infer the existence of one thing or event from the existence of another or a number of others . . .[they] can plausibly claim that when some earlier events are given, only one act or acts within some well-marked character are related to these earlier events." (Russell, 1926, as cited in Tuan, 2012, p. 200)

A facet of reductionism, mechanistic thinking is at the heart of the randomized controlled trial (RCT), a methodology for sifting through non-essential variables in order to determine an essential variable. The RCT is now the gold standard research methodology in clinical research (American Psychological Association Presidential Task Force, 2006; Lilienfeld, Lynn, & Lohr, 2015; Puhakka, 2015) and relies on the statistical value of a reliably direct, moderated, or meditated correlation between two variables.

However, models based on mechanistic thinking can fail quickly when applied to problems of complexity (Gibson & Wilson, 2013; Gleick, 2011). For example, researchers in the 1950s were tasked with predicting the weather. At first glance, the weather appears to have some degree of patterned phases of sunshine, rainfall, and wind speeds. Once reliable relationships are found between meteorological variables (e.g., air pressure and precipitation), it is assumed that accurate prediction would require the analysis of these, and other variables observed throughout an array of weather stations. This data may be then analyzed over time to tease out patterns in the relationships of the variables across the geographical area. A theory of the weather would be devised and then a model constructed to determine a forecasted state based on the current state. The model would then be refined over time until it reaches an acceptable degree of accuracy (Gleick, 2011).

However, while resulting theories were capable of accounting for past weather data, they were not capable of predicting future weather data. Eventually, a time came when it was decided that the problem was unsolvable, and weather prediction remained an intuitive art. In fact, "virtually all serious meteorologists" (Gleick, 2011, p. 22), and indeed most "serious" scientists in the 1960s rejected the prospect of predictive models, and indeed altogether mistrusted the computers that ran them (Gleick, 2011).

While precise prediction was not possible, it was eventually observed that there was some regularity in the way that the weather changed. That is, a weather system possessed a pattern of ordered disorder at higher levels of analysis and over a longer period of time. This observation came when one researcher stumbled across the fact that small changes in the inputs of the simulations would produce more erratic changes in the outputs over time. The more times the outputs of one simulation run were fed back as inputs to the next simulation run, the less the outputs resembled what would be expected given such a small change in the original inputs. This sort of imbalance between inputs and outputs points to the dramatic failing of pure mechanistic thinking: While variables derived from reductionistic analysis may accurately account for past data, they may not always account for future results. The relationships between the variables are simple, the computer algorithms are deterministic, and yet the outputs become more difficult to predict the longer the simulation is left to feed back into itself (Gleick, 2011).

The researcher was Edward Lorenz, and his discovery led to the study of *chaos*. He observed that his computerized weather simulations showed islands of coherence amidst the turbulence, and his discovery was that the two could exist together. This ordered-disorder is most simply conceptualized by understanding how a simple nonlinear equation can produce predictable results when run once, but the results become more unpredictable when the output is fed back into the equation as input. This reflects the requirement that the state of a weather system in one moment determines the state in the next moment. Complex problems like these seem to be creative in their unpredictability; they appear to be alive (Fleischman, 2012).

Lorenz had unwittingly made a discovery that would lead to the study of complexity and terms like *complex systems*, *dynamical systems*, and *chaos theory*. The concept of complexity challenged the paradigmatic assumptions of the time and opened the door to new ways of looking at extremely complex problems like variations in population levels, financial economy, global climate, and, most recently, the functioning of the human body and mind (Siegel, 2012). Yet the assumptions of complexity have not permeated mainstream medical care in the United States, which remains mostly fixed in reductionistic thinking (Diez Roux, 2011; Kapp et al., 2016; Peters, 2014; Trochim, Cabrera, Milstein, Gallagher, & Leischow, 2006). The reigning reductionistic assumptions drive, for example, research into essentially genetic causes of disease and pharmacological remedies to those causes, but they do not provide the flexibility to tackle problems of great complexity or reciprocation such as the influence of interpersonal relationship anxiety on autoimmune inflammation or epigenetic relationships between genes and the environment (Gleick, 2011).

Reductionistic thinking in this way looks for a direct, linear relationship between two variables, such as gene x and disease y. Sometimes x is said to cause y as mediated through z. Alternatively, x correlates with y as moderated by z. In any case, the causal relationship is sought to move in one direction, from x to y (Gleick, 2011; Kazdin, 2016). This type of thinking, which in this study I will term “linear thinking” after Macy’s (1991) term *linear causality*, works well for problems of engineering but fails for problems of complexity where there are sometimes uncountable variables with incomprehensibly complex relationships.

Linear thinking cannot solve every problem, but it certainly can solve many problems as evidenced throughout the span of the industrial revolution (Frodeman, 2013). Therefore, in the search for a type of thinking that is better suited to problems of complexity it may be beneficial first to speculate as to the function of linear thinking in order to understand what limitations must be surpassed. After all, linear thinking is so prevalent in *Homo sapiens* and the “lower” animal cousins that *Homo sapiens* seem to be hardwired for it (Harari, 2015).

Drawing on the descriptions above, one can assume that the function of linear thinking may be to execute a single, precisely defined goal. Complexity is managed in linear thinking by executing many precisely defined goals as in the engineering of the mobile phone. Perhaps it is productive to assume that linear thinking produces solutions conceptually organized in hierarchy, and that hierarchy most visibly functions to optimize the execution of a precisely defined goal. Today hierarchy remains the most intuitive and popular way to organize a commercial kitchen, military, or government. Though there are attempts to organize government with less hierarchy or without hierarchy, such as the system of “checks and balances” in the United States, pure democracy, or pure socialism, any group will fall back on hierarchy given a crisis that is intense enough to require specialized focus and execution. Goal-directed focus then becomes quite clear, as an attendant of the opera would observe in the transition from the multidimensional heights of the imagination while experiencing the performance to the singular need for a toilet when nature calls, or a happy reflection after the show followed by a focused search for food when the stomach growls in protest. Seen in this way, simple linear solutions to important problems prove vital to survival.

Linear Thinking in Modern Medicine

Linear thinking is prevalent in modern medicine where singular solutions for all sorts of ailments can at times appear magical, and hospitals and their governing agencies are organized in hierarchy to administer these solutions via specialized providers working in their appropriately divided departments. But this type of thinking and the resulting style of organization has its limitations. The complex series of events leading to the 1964 U.S. surgeon general's report on smoking triggered wide-scale positive societal changes like increased taxation of tobacco at the state level and the Tobacco Master Settlement Agreement in 1998, but there were many unforeseen negative effects such as changes to the marketing and covert lobbying strategies from the tobacco companies (Trochim et al., 2006). The Affordable Care Act in the United States includes a focus on "population health" as the result of "collective impact" efforts across government agencies but lacks the coordination to accomplish their goals (Kapp et al., 2016). The British National Health Service (NHS) is charged with the enormously complex task of managing more than a million employees, which includes "a wider range of professions (in this case clinical, allied health and managerial) than any other sector of activity in the UK" (Cramp & Carson, 2009, p. 71). The current model of NHS management views each profession sector of the system as a tool used to engineer the organization as if the professions and components were as related as bricks in a wall. The reality is, of course, that a change in one area can greatly affect the other, and the result is the famously ineffective NHS model (Cramp & Carson, 2009).

Similarly, existing research on the transition to adulthood for youth with disabilities focuses on identifying the variables that influence the problem of healthcare transition including "health, personal and environmental factors" (Hamdani et al., 2011, p. 806), but does not consider the complexity of the relationships between the variables which limits and can even harm transition outcomes (Hamdani et al., 2011). Much like weather simulations, these variables can account for past data but the complexity of the problem of healthcare transition for this population makes a thoughtful effort to coordinate them for future development a separate task altogether. Ignoring the relationships between the variables through a mechanistic, atheoretical perspective can lead to unexpected consequences.

A 2014 survey of Eastern-Mediterranean health care officials around the world revealed that costliness, political inertia, and a lack of the basic conceptual capacity in the individuals involved pose significant barriers to coordinating larger-scale, complex analysis of health care systems (El-Jardali, Adam, Ataya, Jamal, & Jaafar, 2014). A related problem was a lack of sufficient health care information systems to produce the amount of data required for more comprehensive systemic evaluation. El-Jardali, Adam, Ataya, Jamal, and Jaafar (2014) concluded that change within individual agencies was not sufficient to create the large-scale effect that government health care agencies are tasked with creating, and that political endorsement would be critical in coordinating the agencies into a cohesive whole. The consensus was that current ways of solving problems are more reactive than proactive, as explained by a policy-maker from Iraq: “The current thinking depends on reactively finding solutions to health systems problems and usually the mechanisms set are unclear and imprecise” (p. 402). Another policy-maker from Jordan reported that “although steps [related to] evaluation are undertaken, they are mostly superficial and non-scientific” (p. 403). One effect of this kind of superficial strategy is that it often does not think all the way through the problem from interventions to effects of those interventions beyond the effects that are desired. A researcher from Palestine reported that,

> At the national level, the health plan utilized steps 1 to 4 [on the design of interventions] but not in a systematic way. Stakeholders were convened and they brainstormed; however, they did not map and conceptualize effects of the intervention in the health system [in Palestine]. They also did not apply the ST approach systematically to examine relationships across components of the health system. (p. 403)

This Band-Aid style of thinking fails to evaluate the assumptions that are used in the decision-making process and does not consider or prepare for the broader consequences of the interventions used.

The Function and Limits of Linear Thinking

Linear thinking in health care is not so different from the type of thinking that fuels heated political debates on industry and the environment. The World

Commission for Environment and Development (WCED) defines the term *sustainability* as "development that meets the needs of current generations without compromising the ability of future generations to meet their needs and aspirations" (WCED, 1987, as cited in Bell & Morse, 2005, p. 409). By this definition, the idea of "sustainability" may be linked to overcoming linear thinking by looking beyond the desired immediate effects of any particular strategy and on to a wider or widest range of effects. That is to suggest that an "unsustainable" practice is one that insufficiently accounts for its effects. Whether one is pro-industry or pro-environment, a stagnating debate could remain until at least one side can escape the lure of linear thinking long enough to produce evidence from multiple levels of analysis into the problems common to all sides. Industrialists and conservationists alike may benefit from a wider-scoped and longer-termed perspective on their chosen context that includes an understanding of the relationships between their most valued resources. If a business is organized for high output but depends on high employee turnover to accomodate the associated grueling working conditions, then the management may benefit from reorganizing to eliminate the overhead associated with frequent firing and resolving personnel conflicts by retaining more employees. If a conservationist argues for the importance of protecting a forest and that forest is also critical to maintaining the ecological stability of the region, the conservationist may choose to strengthen their argument by developing a more comprehensive understanding of the complex ecological relationship between the environment and the resources that the imposing industry, and they themselves, may depend on. If the function of linear thinking is to solve specific problems, is visible in the persuance of one's most basic needs like hunger and safety, and is prevalent in the organization of human groups, then one may assume that humans are primarily wired for linear thinking.

People tend to evaluate situations in terms of unidirectional cause and effect (i.e., linear thinking) even when exposed to evidence that the situations involve variables in complex relationship with one another (White, 2008). This tendency is attributed in part to a limited capacity of the number of variables or relationships that human working memory can hold at once when analyzing a problem. This limitation may influence the assumptions of experimental psychology as well as laypeople by supporting quasiexperimental causal judgements, for example, about the factors related to forest ecosystems and climate change (White, 2015, 2017). In fact, people can typically only hold two or three relationships between variables in mind at once which contributes to a sort of "naïve ecology" (White, 2008, p. 560) based on linear thinking.

If linear thinking functions to solve problems critical for survival but is limited by the capacity to handle problems of complexity, better problem-solvers are those who can move beyond linear thinking (Ying, Kang, Hiong, & Lim, 2014), and organisms tend overall to evolve toward greater complexity and adaptability (M. Kerr & Bowen, 1988). Then, it is possible to assume that moving beyond linear thinking may be a basic evolutionary challenge. That is to say that linear thinking is probably necessary for survival and is built into a human's neorocognitive architecture, but it may also be an important barrier to overcome if humans are to progress toward a way of life more in line with the natural laws and environs that contrain all living things.

The Problem of Compartmentalization in Science and Society

As previously discussed, a tendency of linear thinking is to isolate aspects of complex problems. As this can make complexity manageable, it can also lead to ignorance of the relationships between what is being isolated. This section will provide a philosophical look at the problem of coordination when linear, isolationist thinking dominates in solutions for problems of complexity.

The strength of reductionism is in isolating important information from information that is unimportant for the current focus of attention. A correlation which accounts for partial variance implies that an unspoken variable or variables account for the remaining variance. This haystack of unaccounted-for variance is reduced through controlled experiment to discover the one variable which accounts for a meaningful and reliable amount of the variance. The needle is isolated from the haystack (Kazdin, 2016). Conceptual isolation, then, must be one product of reductionism and of linear thinking. As illustrated in the above section, one weakness of pervasive isolation is poor coordination between isolated entities, whether it is in the sciences, government agencies, or the body and mind system.

Researching the self-organization of social movements, Fuchs (2006) writes that "searching for singular laws of the emergence of movements is an expression of one-dimensional, linear, and deterministic thinking" (p. 101). Instead, many interdependent factors from multiple levels must be combined to understand the overall social climate leading up to the movement. As described above, a fragmented approach to the holistic concept of "population health" in the United States (Kapp et al., 2016) and management of the NHS in the United Kingdom have failed to achieve stated outcomes as a result of poor coordination between both internal systems with internal systems and internal systems with external systems. It is now common clinical knowledge that social isolation increases risk of suicide for those with suicidal ideation (Kaori et al., 2017). Bowen found in his research on the family as an emotional unit that the degree of emotional cutoff from family is one of the most reliable markers of poor DoS, as it reduces the resources available to cope with crisis through emotional inflexibility in the individual (Bowen, 1978). Fragmentation or complete isolation of functional networks in the brain has been found to be a pattern in patients with schizophrenia (Nelson, Bassett, Chamchong, Bullmore, & Lim, 2017).

Specialization in science began in the early Enlightenment when certain regions of the world were found to possess special advantages for certain experiments. For example, experiments with heat were easy to come by in most populated areas, but it was not yet possible to produce colder temperatures needed for experiments that required them. After increased European interest in the aurora borealis (northern lights) during the 1710s and 1720s when a surge in solar activity made them visible in southern areas, it became apparent that northern countries had a special advantage not afforded in southern climates (Pihlaja, 2012). A debate about the idea of scientific specialization ensued. Before this period, science had consisted of a small number of amateurs approved by the church to deduce knowledge from existing conceptions of the world. The new science of diverse specialists challenged this old view. In the new view, an increasing number of specialists would combine their observations to generate new conceptualizations of the world. Experimentalists and observers of nature began collecting data from particular areas (literally and figuratively) of expertise and reporting back to emerging scientific organizations who would aggregate and discuss the findings. These organizations, such as the Royal Society in Britain and Académie des Sciences in France, began aggregating and publishing the work in journals, which also gave opportunities to amateurs to become known in the field (Pihlaja, 2012).

Astronomy was the first field to collectively organize scientific observation from many places around the globe. This ideal of cooperation was integral to the original idea of specialization, and it drew life from the value of diversity in the sciences, not only from geographical specialties but from the sheer size of data produced through collaborative effort (Pihlaja, 2012). The French Académie of Sciences, precursor to the National Institute of the Sciences, has written in their *Historie:*

> not only because the spirits need to enrich each other's views, but because the different Countries have different conveniences and different benefits for the sciences. The Nature reveals itself in varying ways for the various inhabitants of the World; she provides ones with objects for deliberation which others do not have, and announces herself sometimes more or less, depending on the region. (Académie des Sciences, 1733, as cited in Pihlaja, 2012, p. 130)

Thus, the amount of analytical specialization in science increased.

However, the spirit of synthesis did not grow with the spirit of analysis. Nowhere is this more clearly seen than in the explosion of the field of professional physics following World War II. The number of article abstracts in *Physical Review*, an internationally published British journal founded in 1898 which aggregated abstracts from many scientific journals, grew from 4,090 abstracts in 1948, to 7,500 abstracts in 1949, over 10,000 in 1954, and 84,000 in 1971 before stabilizing (Kaiser, 2012). The prominent U.S. journal *Physics Review* had to constantly update its index of subjects to keep up with the increased level of specialization throughout the 1950s. "By 1955, major fields like nuclear physics, separated into six subcategories, had been added to the list. Ten years later, nuclear physics had been carved up into thirty-five distinct subcategories, and solid-state physics into thirty-eight" (Kaiser, 2012, p. 296). Unfortunately, the unprecedented explosion and specialization did not come with a complimentary degree of coordination. Samuel Goudsmit, the editor of the *Physical Review,* explained the increased isolation of specialists in 1966,

> the journal "is no longer similar to the neighborhood grocery store where old customers get personal attention." Instead it had become "more like a supermarket where the manager is hidden in an office on the top floor. As a result, lots of things are just done by routine rather than by human judgment." (Kaiser, 2012)

In *Consilience*, E. O. Wilson (1998) writes of the compartmentalization of the sciences as an artifact of scholarship and not of nature. Our current social structure is simply not prepared to handle problems which require communication across disciplines, such as environmental policy, ethics, biology, and social science, as the disciplines are not united in a common language or set of principles through which to base a collaborative effort. E. O. Wilson writes,

> Each has its own practitioners, language, modes of analysis, and standards of validation . . . There has never been a better time for collaboration between scientists and philosophers, especially where they meet in the

> borderlands between biology, the social sciences, and the humanities. (p. 9)

E. O. Wilson argues that "we are approaching a new age of synthesis, when the testing of consilience is the greatest of all intellectual challenges" (pp. 11–12), and that this change will only occur when a shift is made toward the early enlightenment ideal of the synthesis of knowledge,

> Win or lose, true reform will aim at the consilience of science with the social sciences and humanities in scholarship and teaching. *Every college student should be able to answer the following question: What is the relation between science and the humanities, and how is it important for human welfare?* [italics added] Every public intellectual and political leader should be able to answer that question as well. Already half the legislation coming before the United States Congress contains important scientific and technological components. Most of the issues that vex humanity daily—ethnic conflict, arms escalation, overpopulation, abortion, environment, endemic poverty, to cite several most persistently before us—cannot be solved without integrating knowledge from the natural sciences with that of the social sciences and humanities. Only fluency across the boundaries will provide a clear view of the world as it really is, not as seen through the lens of ideologies and religious dogmas or commanded by myopic response to immediate need. Yet the vast majority of our political leaders are trained exclusively in the social sciences and humanities, and have little or no knowledge of the natural sciences. The same is true of the public intellectuals, the columnists, the media interrogators, and think-tank gurus. The best of their analyses is careful and responsible, and sometimes correct, but the substantive base of their wisdom is fragmented and lopsided. (E. O. Wilson, 1998, p. 13)

In his writing on systems philosophy, Erwin Laszlo (1971) argued for the return of philosophy to the most important problems of the day, in that philosophy has lost its grounding in substantive questions about nature and the sciences through increased specialization of science: "Lest philosophers analyze themselves out of philosophy, a return must be effected to synthesis. . . . Synthesis can mean the conjoining various sets of non-philosophically researched data, to furnish new avenues toward the constructive discussion of substantive philosophical issues" (p. 55). Frodeman (2013) writes,

> The institutional status of philosophy—e.g., its functioning as a discipline—was the great blind spot of twentieth (and now twenty-first) century philosophy. This is part of what has led philosophy, potentially the most relevant of subjects, to become a synonym for irrelevance." (p. 1918)

It is uncoordinated specialization which detracts from the meaning-making which can occur through synthesis. Laszlo suggests that reductionism is the new nihilism. People need to feel as though they have a purpose, as though their existence plays some role in the big picture. Laszlo (1971) writes,

> In earlier epochs they were guided by synthetic modes of thought which rested in part on faith and imagination; but the great myths of former ages and the religions of our immediate heritage have lost their cogency to millions. According to "ideologues," they are capable of being replaced by action-oriented ideologies, like Nazism and Communism, which present a total world-view with explicit directives for action. (p. 112)

Laszlo argues that the obsession with analysis and subsequent loss of meaning partially accounts for the surging popularity of "Eastern sacred texts, astrology, reincarnation, states of consciousness, and the like" (p. 112). Thus, science, the humanities, and spirituality are intimate bedfellows through the common "demand to 'see things whole'" (Laszlo, 1971, p. 112). "All this requires the resuscitation of a mode of rational and systematic thinking which has fallen into disrepute through overinsistence on detailed investigation and specialization" (Laszlo, 1971, p. 113).

This dilemma was as alive in the 19th century as it is today, when Nietzsche wrote,

> The dangers for a philosopher's development are indeed so manifold today that one may doubt whether this fruit can still ripen at all. The scope and the tower-building of the sciences has grown to be enormous, and with

> this the probability that the philosopher grows weary while still learning or allows himself to be detained somewhere to become a 'specialist':—so he never attains his proper level, the height for a comprehensive look, for looking around, for looking down. Or he attains it too late, when his best time and strength are spent—or impaired, coarsened, degenerated, so that his overall value judgment does not mean much anymore. It may be precisely the sensitivity of his intellectual conscience that leads him to delay somewhere along the way and to be late: he is afraid of the seduction to become a dilettante. (Nietzsche, 1886, as cited in Frodeman, 2013, p. 134)

"The world has problems, but universities have departments" (Brewer, 1999, p. 328). All propose the solution of philosophy's return as a binding force in the application of science to human life. Frodeman (2013) writes, "Philosophers need to get out of the study, and into the field" (p. 1918) and begin to combine the fruits of analytical science for the good of human life. E. O. Wilson (1998) believes that the thinkers of the enlightenment "got it mostly right the first time" (p. 8) assuming a "unity of knowledge" (p. 8) as in Sir Francis Bacon's utopian *Solomon's House*, a loom weaving together the threads of knowledge contributed by different scholars of different problems (Pihlaja, 2012).

That early Enlightenment ideal resulted in an explosion of curiosity about the natural world that became "the West's greatest contribution to civilization" (E. O. Wilson, 1998, p. 14). The result of an effected synthesis could be an evolutionary leap for science's ability to handle the pressing problems of today. If reductionism implies atomism, then the above may appear a case for its opposite, *holism*. But holism in itself, which holds the entire problem in view providing the opportunity for properties of the whole not evident in the parts to emerge, is still a branch too far from the trunk (Bunge, 1977).

Barring claims of omniscience from sages of the ancient past, I posit that no human possesses nor can make use of all there is to know of the natural world. Yet, progress in all forms can be well informed by the thoughtful coordination of diverse minds and abilities. Analysis and synthesis have their places, and yet some kind of integration is required. A way of thinking is needed that can simultaneously account for the part as well as the whole. This way of thinking would move freely between synthesis and analysis and possibly go beyond synthesis and analysis.

Challenges to Psychology as a Science

In this section I will address how poor differentiation between popular psychological research paradigms leads to tension between them. Particular attention will be paid to the disparity between the call for evidence-based practices in mainstream professional psychology with the popularity of subjective clinical theories, which reflects the long-standing gap between the human sciences and the natural sciences. The section concludes with the suggestion that if psychology is to move toward an accepted science of human behavior then objective, integrative theory is needed which can account for and predict problems of complexity in the human condition.

Research Paradigms in Psychology

The philosophy of the Enlightenment was positivistic, which assumes an objective reality which can be accurately known through controlled experiment. A positivist experimenter looks for empirical evidence which confirms a hypothesis and assumes that the experiment is an accurate representation of reality (Kazdin, 2016). Postpositivism augmented positivism acknowledging and attempting to limit the bias or influence of the researcher or experiment, something which is particularly important in the social sciences (Ponterotto, 2005). Karl Popper's criterion of *falsification*, that is, that a theory is only scientific if it is possible to disprove it, originated as a critique of Freud, Adler, and Marx's theories. Popper proposed these theories fail the test of falsification and so are no closer to science than myth (Popper, 1963/2002). The postpositive criterion of falsification anchors theoretical concepts in the objective domain.

A postpositivist experimenter would conduct a positivist experiment but clearly state known biases and limitations, and endorse a result as agreed by multiple raters or a double-blind to minimize experimenter bias (Ponterotto, 2005). The goal of experimentation in postpositivism is, as Richard Feynman (1985) put it, "bending over backwards to show how you are maybe wrong" (p. 313). Positivism and postpositivism are most concisely differentiated by verification and falsification, respectively (Ponterotto, 2005). "Whereas a million white swans can never establish, with complete confidence, the proposition that all swans are white, one black swan can completely falsify it" (Guba & Lincoln, 1994, p. 107). If the strength of the positivistic paradigm is the incremental accumulation of knowledge through verification of analytical questions, a weakness can be in increasing understanding when specific questions are not yet available particularly for individual differences within a sample.

Many clinicians formulate treatment around constructivist theories. Constructivist, and, later, critical theories assume that there is not one objective truth but many truths as defined by (i.e., constructed through) the subjective experience of each individual (Ponterotto, 2005). Constructivist approaches increase understanding of a problem by opening the door to new and unexpected information, that is, “there is no wrong answer.” For example, this attitude of curiosity is useful for exploring the feelings, phantasies, and associations of a patient, or to expose the lived experience of a particular group of people (Ponterotto, 2005). If a strength of this approach is in increasing understanding of a subject where no specific question has yet been posed, a weakness may be in the erosion of reliable knowledge in extreme cases due to the rejection of the anchor of objectivity which prevents falsification. Constructivism alone cannot produce testable theories which by definition are postpositivist, and problems arise when claims of objective validity are made within this paradigm. Popper, once enamored with Freudian theory, was careful to highlight the usefulness and plausibility of Freud’s ideas in his critique. He claims,

> This [failure of the falsifiability criterion] does not mean that Freud and Adler were not seeing certain things correctly: I personally do not doubt that much of what they say is of considerable importance, and may well play its part one day in a psychological science which is testable.” (Popper, 1963/2002, p. 49)

Freud (1915/1953) himself was clear about the importance of refuting or replacing his provisional concepts as appropriate to future evidence, as he writes,

> It is only after more thorough investigation of the field of observation that we are able to formulate its basic scientific concepts with increased precision, and progressively so to modify them that they become serviceable and consistent over a wide area. Then, indeed, the time may have come to confine them in definitions. The advance of knowledge, however, does not tolerate any rigidity even in definitions. Physics furnishes an excellent illustration of the way in which even “basic concepts” that have been established in the form of definitions are constantly being altered in their content.” (p. 116)

According to Popper, the only thing that Freud (and Adler's) theory confirmed was "that a case could be interpreted in the light of the theory" (Popper, 1963/2002). Every subsequent instance of confirmation simply added to the impression that the theory was correct. There now exists a plethora of theoretical schools derived from Freud's "science" which, while intuitively logical and supported by confirming evidence in therapy, use concepts and language specific to their own theoretical formulation and lack an objective basis to organize critique between the (Bowen, 1978). Zepf (2010) laments in the *Journal of the American Academy of Psychoanalysis and Dynamic Psychiatry*, "The theoretical and technical-therapeutic conceptualizations of, for instance, self-psychologists, object-relationists, attachment theorists, intersubjectivists, Lacanians, social-constructivists, Kohutians, neo-, post- and contemporary Kleinians, ego-psychologists, orthodox and so-called post-Freudians contradict one another to a considerable extent" (p. 463). The problem surfaces again in the question of requirements for psychoanalytic training instructors, where "every training analyst teaches either his or her interpretation of a concept he or she values for whatever reasons, or, as is mostly the case, his or her personal, eclectic selection of concepts taken from different theories" (p. 465). This sort of critique apathy, possibly facilitated by constructivist views in clinical theory, has created a situation where each theory is seen as "equally valid despite the contradictions between them" (p. 466) and the meaning of theoretical concepts become more a matter of opinion of the analyst than postpositivist science based on evidence.

Differentiation of Research Paradigms

While each paradigm may have its own part to play in the grand scheme of science, problems arise when research conducted in one or a mix of these paradigms lay claim to the same title of "science." They reinforce their allegiance through the publication of scientific journals which define the paradigm (Noone, 2016). However, it is possible for literature within a paradigm to make use of definitions of basic research terms which are incompatible with other paradigms which also claim to be scientific (Bowen, 1978; Baldwin, 2018; Lindsay & Boyle, 2017; Smith, 2018; Sokal, 2017; H. Wilson, 2017).

One recent and humorous incident illustrates the problem of claiming scientific validity in the constructivist paradigm. Lindsay and Boyle (2017) produced an article using language and terms common to postmodern and feminist journals, but they developed the theoretical concepts from their own imagination. The article, which was authored specifically without researching the theories it referenced and included many openly contradictory sentences, managed to be accepted and published in the journal *Cogent Social Sciences*, a "fully peer-reviewed, open access journal" (Taylor & Francis Online, n.d.). The authors claimed to have been inspired by an even earlier hoax where Alan Sokal submitted an article to the journal *Social Text* in 1996 (Sokal, 2017).

Nevertheless, systematic research of subjective experience within the constructivist paradigm may contribute to postpositivist hypothesis generation or may simply add to a relativist canon of historical record bereft of inductive inference. Other constructivist psychological philosophies such as critical psychology may not claim to contribute to knowledge where the goal of research is to affect the individual or group more than it is to observe it (Ponterotto, 2005).

Poor differentiation between research paradigms in psychology may contribute to polarization between professional and research psychologists, as clinical theory exists in the constructivist paradigm while policy and funding is governed by bodies within the postpositive paradigm. As of this writing, the American Psychological Association (APA) defines *psychology* in their online Dictionary of Psychology as "the scientific study of the behavior of individuals and their mental processes" (Psychology, 2017, para. 1), and then defines *science* as "the set of procedures used for gathering and interpreting objective information in a way that minimizes error and yields dependable generalizations" (Science, 2017, para. 1). The terms *objective information* and *minimizes error* bind the American Psychological Association's philosophy of science squarely within the postpositivist paradigm, which accepts the importance of qualitative research but implicitly limits constructivist philosophies to service in the hypothesis-generating phase of the postpositivist pipeline. The American Psychological Association requires evidence-based practices (EBP) to be the mainstay of clinical training and treatment, defining *evidence* as,

> derived from clinically relevant research on psychological practices . . . based on systematic reviews, reasonable effect sizes, statistical and clinical significance, and a body of supporting evidence. The validity of conclusions from research on interventions is based on a general progression from clinical observation through systematic reviews of randomized clinical trials, while also recognizing gaps and limitations in the existing literature and its applicability to the specific case at hand. (American Psychological Association, 2006)

The American Psychological Association limits subjective opinion to the role of "clinical expertise" in the context of scientific evidence and leaves the door open to working around the limits of positivistic science. In 2006, the APA Presidential Task Force on Evidence-Based Practice issued a report stating that

> researchers and practitioners should join together to ensure that the research available on psychological practice is both clinically relevant and internally valid. It is important not to assume that interventions that have not yet been studied in controlled trials are ineffective. (APA, 2006, p. 275)

This flexibility requires continual pressure from the research *and* clinical communities to refine what is considered evidence based to be both valid and relevant to clinical practice and the human condition. Based on the current stance of the American Psychological Association on evidence as objective data, this pressure should include questioning of the philosophical assumptions that underline clinical theory and the consequences of untestability stemming from them.

One source of the conflation of research paradigms in psychology is the *Diagnostic and Statistical Manual of Mental Disorders* (*DSM-V*), now in its fifth edition (American Psychiatric Association, 2013). The *DSM-V* provides a descriptive nosology for mental disorders after the fashion of the medical field but provides no etiological theory to explain their relationships or guide research. The introductory chapter of the *DSM-V* describes the emphasis on statistical reliability of the criteria in place since the third edition and how this emphasis continues today in the fifth edition. However, since the publishing of its predecessor in 1844, the diagnoses contained in the *DSM* have been derived from the analysis, however rigorous, of consensus among clinicians and comparison of those agreements to patient self-report (American Psychological Association, 2006). The current version of the *DSM* is promoted as an exhaustively rigorous example of positivistic science, but the methodology described in the introduction only speaks to the development of reliable opinions, not whether those opinions are correct. It cannot claim to represent objective empirical data derived from nature. Further, the *DSM* is far from generating reliable differential diagnoses with the precision common to biological medicine, probably due to significant overlap between diagnostic criteria. From the introductory chapter in the *DSM-V*,

> The results of numerous studies of comorbidity and disease transmission in families, including twin studies and molecular genetic studies, make strong arguments for what many astute clinicians have long observed: the boundaries between many disorder "categories" are more fluid over the life course than DSM-IV recognized, and many symptoms assigned to a single disorder may occur, at varying levels of severity, in many other disorders. . . . In short, we have come to recognize that the boundaries between disorders are more porous than originally perceived. (American Psychiatric Association, 2013, pp. 5–6)

It is possible that diagnoses appear so “porous” because of a lack of etiology, however provisional, to the purely descriptive criteria provided in the manual. This lack of etiology led the NIMH, currently the world’s largest funding agency for research into mental health, to issue a strong blow to the *DSM* by withdrawing funding for research based purely on *DSM* diagnoses (Insel, 2013). The NIMH described its reasons for the decision a few days before the *DSM-V* was published,

> The weakness is its lack of validity. Unlike our definitions of ischemic heart disease, lymphoma, or AIDS, the DSM diagnoses are based on a consensus about clusters of clinical symptoms, not any objective laboratory measure. In the rest of medicine, this would be equivalent to creating diagnostic systems based on the nature of chest pain or the quality of fever. (Insel, 2013, para. 2)

Perhaps more alarming is the rather extensive technical introduction in the *DSM-V* written to promote the scientific validity of the manual with no mention of its obvious scientific shortcomings. If the American Psychological Association is to endorse the *DSM* as "the standard classification of mental disorders" (American Psychological Association Services, n.d., para. 1), then there is much progress to be made toward psychology as a science.

In the same statement announcing the withdrawal of funding for *DSM* research, NIMH announced their exclusive support for their own research domain criteria (RDoC), an alternative research framework intended to produce diagnostic criteria based on biology (Insel, 2013). Though commentary on the still-new RDoC is scarce, critics suggest that "overinvestment" of resources into the RDoC model precedes the development of well-defined categories backed by scientific evidence showing that they improve the wellbeing of patients (Kaplan, 2016; Weinberger, Glick, & Donald, 2015). Weinberger, Glick, and Donald (2015) write that though RDoC may improve on the problem of validity in the *DSM-V* and provide a much-needed framework for research, it (a) contains physiological dimensions developed by researchers without clinical experience and with no empirical evidence to support them, (b) "does not recognize the implications for categorization incurred by the unexpected discoveries of psychopharmacologic treatment" (pp. 1162–1163), (c) uses a dimensional model which does not allow the distinguishing of wellness versus illness, and (d) cannot provide an explanation of how a patient gets sick and then gets better in order to guide and assess treatment. RDoC is also an atheoretical reductionist model which ignores the possibility of symptoms arising as emergent properties, which may have been a strength of the black-box holistic approach of the *DSM*.

If psychology as the study of human behavior is to become an accepted science in the postpositivist realm, then there is a need for theories which generate testable clinical hypothesis which put predictive theory to the test. There is also a need for theoretical concepts which are communicable with other scientific disciplines (E. O. Wilson, 1998). For example, a clinical psychologist who uses object relations theory will have difficulty drawing from or contributing to evolutionary biology research to refine that theory, as an “object” (Winnicott, 1969) is a theoretical concept that describes an immaterial artifact of human subjectivity. It does not accurately explain observations in other species. Therefore, the degree of objectivity in this and similar subjective conceptualizations is diminished.

A major challenge to psychology as a science is to move beyond reductionism into a paradigm which can account for problems of complexity. That is to suggest that there is need for an integrative theory that also retains predictive power. There must also be theory which distinguishes wellness from illness beyond the presence of isolated reductionistic physiological markers as defined in RDoC.

Attachment theory is one example of a step in the direction of explaining behavioral problems based on the complex reciprocal interactions between the child and caregiver. This represents a step beyond linear thinking akin to cybernetic theory, but maintains a linear-causal relationship between the caregiver and child's attachment styles and represents a move back to linear thinking (Dallos, Lakus, Cahart, & McKenzie, 2016; Ross, Hinshaw, & Murdock, 2016). This linear-causal view of a phenomenon as complex as child development certainly has limitations. For example, in my research I found no conceptualization in attachment theory to explain or predict varying attachment styles among siblings with the same primary caregiver. While the descriptive concept of *self-state* may account for some complexity and dynamism in individual's behavior, it is not clear that this concept is defined well enough to generate falsifiable hypotheses. As was the case with meteorological variables in the weather prediction as described in the earlier section on complexity in science, descriptive concepts like self-states may explain past data but do not provide a pathway to theory which can predict future data.

Developing concepts which pertain to observable interactions between people as opposed to assumed phenomena occurring within people could open pathways to more objective and falsifiable hypotheses. However, one solution to overcome linear-thinking would be to research the effects of the primary caregiver's relationships with other members in the family as a complex system. This is effectively what Bowen (1978) worked to do, even if the term complex system had not come into popular use. BT will be reviewed later in this document as one example of a set of rich concepts that can organize such complex observational data in research.