© Journal of Higher Education Outreach and Engagement, Volume 23, Number 3, p. 199, (2019)
 eISSN 2164-8212

Engaging With Complexity: Making Sense of "Wicked Problems" in Rural South Africa

Christopher J. Burman

Abstract

This article provides insights into the utility of applying theories associated with the complexity sciences to engaged research. The article reflects on a 4-year health-related engagement between the University of Limpopo and the Waterberg Welfare Society in the Limpopo Province, South Africa. The introduction presents the focus of the partnership and the outputs to date. The sections that follow introduce (1) background information about the partnership, (2) the notion of "wicked problems" and resilience, (3) theory relating to anthropogenic complexity that influenced the project, and (4) a description of the taming wicked problems framework, which was developed to facilitate the intervention. The discussion reflects on learning from the project in the context of engaged research, wicked problems, and resilience. It is suggested that building resilience to wicked problems represents a useful addition to engaged scholarship's armamentarium of toolkits from both conceptual and practical perspectives.

Keywords: community engagement, HIV and AIDS, medical pluralism, nonlinearity, project management, metaphorical order/chaos continuum

This reflection introduces an approach to engaged research that was designed to build resilience to "wicked problems" in rural South Africa, the taming wicked problems framework (henceforth the Framework). The Framework was designed to facilitate a community–university response to an intractable wicked problem identified by a community-based organization in the context of Mode 2 knowledge generation, with "Mode 2" understood to be knowledge cogeneration "for the sake of social change and transformation" (de Beer, 2014, p. 133). The Framework was developed from the perspective of transdisciplinary theory—inclusive of complexity sciences—to catalyze the emergence of novel ideas and associated social practices that would contribute to change and transformation. In this instance, the wicked problem identified by the community partner related to HIV and AIDS. Although the partnership has not solved the problem, it has developed resilience strategies to reduce its influence. The specific project impacts to date include an increase in adherence to antiretroviral medication and a decrease in internalized stigma among traditionalists living with HIV, both of which are priority areas in the current South African National Strategic Plan for HIV, TB, and STIs (South African National AIDS Council [SANAC], 2017).

The purpose of this reflection is to provide insights into the benefits of explicitly incorporating nonlinear dynamics into engaged research; to describe the opportunities that are afforded by working with ambiguous concepts such as serendipity and feedback; and to demonstrate how academe and community collaborated to develop a now self-sustaining resilience strategy to ameliorate the impact of a wicked problem in rural South Africa.

The reflection is structured in the following way. First the partnership and setting—contextualized by the changing

global/local HIV and AIDS environment—is presented. This is followed by an excursus into wicked problems, resilience, and nonlinear complexity, then a description of the Framework. The Discussion section begins with a metatheoretical reflection relating to the ontological/epistemological positioning of the Framework, followed by implementation-level reflections relating to some of the learning from the project.

Background Information

Project History

The partnership has been reported on elsewhere, and only the key points will be highlighted (Burman, Aphane, & Mollel, 2017). The partnership is between the Rural Development and Innovation Hub, University of Limpopo, and the Waterberg Welfare Society (WWS). The partnership began over 10 years ago, and this ongoing project began in 2014. Ethical clearance was approved by the Turfloop Research and Ethics Committee at the beginning of the project, and appropriate ethical procedures and protocols have been applied throughout.

WWS is a not-for-profit organization that was founded to counter the growing HIV and AIDS epidemic in 2006. It comprises teams of social workers, nurses, and peer educators who primarily work with communities living in deep rural areas (WWS, 2017). Waterberg district is situated in the west of the Limpopo Province on the border with Botswana. It is a deep rural district with a Gini coefficient of 0.67, representing one of the most unequal districts in the country (Mostert & Van Heerden, 2015). The most recent statistics indicate that HIV prevalence rates among antenatal women within the district during the period 2008–2013 remained stable at fractionally below 30% (National Department of Health, 2015), but more recent figures indicate a gradual average national decline in incidence rates, which is probably reflected in Waterberg district (SANAC, 2017). (Note, however, that the last South African National HIV Prevalence, Incidence and Behaviour Survey providing district-level statistics was published in 2012; an exponential increase in antiretroviral treatment coverage has occurred in the intervening period.) During the early phases of the project, the HIV and AIDS environment was going through a global shift due to the introduction of UNAIDS' 90-90-90 strategy to end AIDS by 2030 (Joint United Nations Programme on HIV/AIDS, 2014). The wicked problem identified by WWS was how to reframe their HIV risk reduction messaging in this changing context.

The Changing Global/Local HIV and AIDS Environment: 90-90-90

With the consolidation of evidence that antiretroviral therapy (ART) makes it "biologically possible to all but eliminate HIV transmission from those individuals already infected," as well as to extend the life expectancy of infected individuals exponentially (Bayer, 2014, p. 436), the South African National Department of Health officially adopted the 90-90-90 strategy, meaning "90% of all people living with HIV know their HIV status; 90% of all people with an HIV diagnosis receive sustained antiretroviral therapy, and 90% of all people receiving antiretroviral therapy achieve viral suppression" (SANAC, 2017, p. xv). In 2014, 90-90-90 represented a qualitative shift in the global/local HIV and AIDS environment, and WWS consequently wanted to update their educational and awareness materials accordingly. This required replacing the outdated "abstain, be faithful, condomise" (ABC) messaging with new educational and awareness materials aligned with the biomedical 90-90-90 paradigm.

Although in hindsight this may seem to be a straightforward task, the reality is that it was difficult. The difficulties included (1) very few of the project team understood the full implications of the biomedical logic that explained the opportunities that 90-90-90 provided, (2) the legacy of the ABC messaging was firmly embedded among the communities that WWS worked with, and (3) it was impossible to predict what type of educational and awareness materials would make sense to the intended beneficiaries in the changing HIV and AIDS environment. Despite a number of attempts to update the educational and awareness materials, WWS remained at an impasse, so it was decided that the partnership should focus on codeveloping new educational and awareness materials from the perspective of wicked problems and resilience.

Wicked Problems

The widely accepted consensus is that wicked problems "involve multiple interacting systems, are replete with social and institutional uncertainties, and [are those]

for which only imperfect knowledge about their nature and solutions exist" (Mertens, 2015, p. 1). Consequently wicked problems (1) are considered to be "any complex issue which defies complete definition and for which there can be no final solution . . . in that they resist the usual attempts to resolve them" (Brown, Harris, & Russell, 2010, p. 302)—but it is possible to develop resilience to the challenge by taming their "growl" (Churchman, 1967, p. B-141)—and (2) are especially resistant to resolution if only conventional, linear analytical approaches based on Newtonian reductionism are applied to attempt to change them (Sharts-Hopko, 2013). Furthermore, unintended outputs often emerge during interventions or programs designed to reduce the impact of wicked problems (Australian Public Service Commission, 2007) because "wicked problems are nonlinear, [so] any approach to tackle them must be every bit as nonlinear" (Pacanowsky, 1995, p. 37). Nonlinearity refers to the dynamics of complex systems as described below.

Complexity in the Context of Engaged Research

Ordered, linear systems are sustained by multiple cause–effect interactions between their parts, representing a form of functional complicatedness situated within a closed system, such as an airplane. Linear systems are considered to be ordered because they are at, or close to, equilibrium. They are therefore predictable but vulnerable to shocks, because if one part of the system becomes dysfunctional, the entire system can fail. An example of a complete system failure due to one part of a system becoming dysfunctional is an airplane that has had the front wheel removed prior to takeoff. In this instance, the entire system ceases to function. The analysis of ordered, linear systems is associated with the Cartesian positivist method—"systematic observation, replicable experiments, logically deduced hypotheses confirmed by evidence"—because the system functioning is mechanistic, the outcomes deterministic (predictable), and the parts of the system can be legitimately analyzed as independent units (reductionism; Dunn, Brown, Bos, & Bakker, 2016, p. 2).

Unordered systems, such as anthropogenic and ecological systems, are situated within open systems and contain some nonlinear connectivity between the agents in the system, which makes the system context sensitive. "Nonlinear connectivity" refers to the way feedback loops that either amplify (increasing the likelihood of a systemic change) or dampen (reducing the likelihood of a systemic change) potentials for change within a nonlinear system sometimes have disproportional effects, so that "minor changes [within one part of a nonlinear system] can produce disproportionately major consequences" (Snowden & Boone, 2007, p. 71). One real-world example of nonlinear connectivity is combination antiretroviral therapy, which involves "a cocktail of three drugs that works precisely because the immune response and viral dynamics are non-linear. The three drugs taken in combination are much more effective than the sum of the three taken separately" (Ramalingham, 2013, p. 228).

As a result of these dynamics, a nonlinear context-sensitive system may remain at a close to equilibrium position for much of the time but has the potential to move from the equilibrium point if the context alters. The ability of systems to respond to a changing context has been described as a form of "*relational* [emphasis added] complexity" (Healey, 2007, p. 525). For example, the passengers on an airplane mostly display linear characteristics during a routine flight (i.e., ignore the safety DVD, eat, sleep, read and/or watch a movie), but if the plane rapidly loses altitude, the passengers' response will typically catalyze the system to show a different type of functioning that, although not entirely predictable, is likely to be patterned (i.e., variable displays of panic and/or alarm).

The passengers on the airplane represent an example of the tendency of nonlinear systems to remain at a point close to order for long periods (a routine flight) while possessing the capacity to shift far from the equilibrium position if the context alters (rapid loss of altitude) toward the "edge of chaos" (Lorenz, 1972). Unlike linear systems, systems that contain some nonlinearity are resilient, which means that they possess the agility to recover from shocks and thus have the tendency to return to a new point of order after the shock. For example, if the pilot resumes control over the airplane and assures the passengers that there is no crisis, they will probably relax and continue with the flight in a routine way (i.e., the system returns to a close to equilibrium position), but the system will

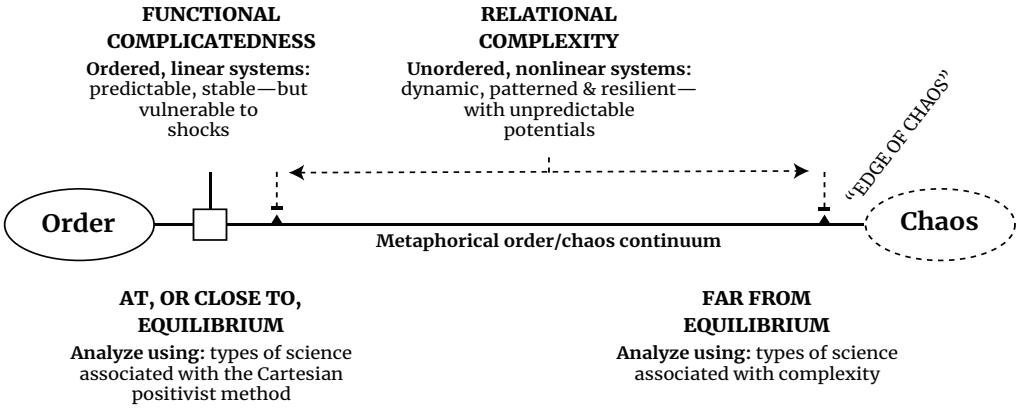

Figure 1. Linear and Nonlinear Systems Contextualized by the Metaphorical Order/Chaos Continuum

not return to exactly the same pre–altitude loss equilibrium point due to the memory of the engine failure and anxiety associated with the altitude loss being embedded within the system. Nonlinear systems are best analyzed using techniques associated with the complexity sciences, which emphasize the "clear identification of the *limits* [emphasis added] to predictability" while "constructing an unknowable future" (Stacey, 2000, pp. 90, 92). The characteristics of linear and nonlinear systems are represented in Figure 1, using a metaphorical order/chaos continuum.

Linear systems remain anchored to a point on the metaphorical order/chaos continuum close to, or at, equilibrium regardless of changes in the context. Nonlinear systems tend to hover at a close to equilibrium point on the order/chaos continuum for long periods of time; however, they have the capacity to move along the continuum as their context alters. Typically, a change in context, such as an exogenous shock, catalyzes movement from the point of ordered stability (equilibrium) toward a far from equilibrium point close to, or at, the "edge of chaos." The movement along the continuum is both self-regulating and self-organizing, which means that the degree of movement is impossible to predict, although patterns of movement tend to be replicated (Pincus & Metten, 2010).

Systems that contain some nonlinearity are resilient because, unlike an airplane, they "can survive the removal of parts by adapting to the change" (Rickles, Hawe, & Shiell, 2007, p. 933) and are capable of qualitative changes if the system goes beyond a tipping point (Gladwell, 2000). These characteristics go some way toward explaining why attempts at solving wicked problems often result in system recovery, in which the system returns to a position at, or close to, its original condition after an exogenous shock (such as attempts to solve the wicked problem). The qualitative differences in linear and nonlinear system functioning have implications for the management of engaged activities, as described below.

Managing Nonlinear Systems in an Engaged Context

Anthropogenic systems represent nonlinear systems (Kauffman, 2005), and, as noted above, nonlinear systems are context sensitive and are prone to unpredictable movement within the metaphorical order/chaos continuum. This requires a project management strategy typology that is cognizant of the uncertain potentials for movement.

> Simple contexts require straightforward management and monitoring. Here, leaders *sense*, *categorize*, and *respond*. That is, they assess the facts of the situation, categorize them, and then base their response on established [good, or best] practice. [In a complex context], we can understand why things happen only in retrospect. Instructive patterns, however, can emerge if the leader conducts experiments that are safe to fail. That is why, instead of attempting to impose a course of action, leaders must patiently allow the path forward to reveal itself. They need to *probe first, then sense, and then respond*. (Snowden & Boone, 2007, pp. 68-72)

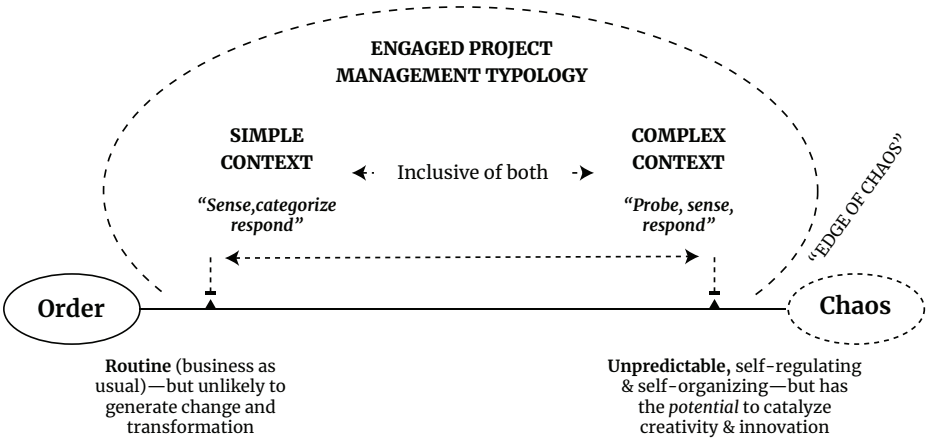

Figure 2. Managing Nonlinearity—an Inclusive Typology

The project management typology proposed by Snowden and Boone (2007) represents a functional heuristic. However, from the perspective of managing Mode 2 engaged partnerships that aim to build resilience to wicked problems, this methodology masks the opportunities that can be exploited to catalyze ameliorative change. When an anthropogenic system is close to equilibrium (order), it is reasonably predictable and thus straightforward to manage using good, or best, practices. However, when an anthropogenic system is far from equilibrium, it is unpredictable and requires a different management response. Implicit within the unpredictability is the potential for grassroots creativity and potential innovation to emerge. This opportunity is represented in Figure 2.

Notwithstanding the potentials of nonlinear systems to move along the order/chaos continuum in response to a change in context, these systems tend to gravitate toward order because of their resilience (Chaffin & Gunderson, 2016). Nevertheless, a simple context requires conventional project management strategies—that is, good, or best, practices—because the interactions of the parts are proportional, hence predictable. In a complex context different management strategies—such as safe to fail experiments—are required because, at that time, the system becomes unpredictable, so a pragmatic project management strategy is to "patiently allow the path forward to reveal itself [as] instructive patterns emerge" (Snowden & Boone, 2007, p. 72). The unpredictability is a consequence of changes within the system that are mediated by amplifying and dampening feedback. This system is represented using Sohail Inayatullah's "iceberg metaphor" in Figure 3.

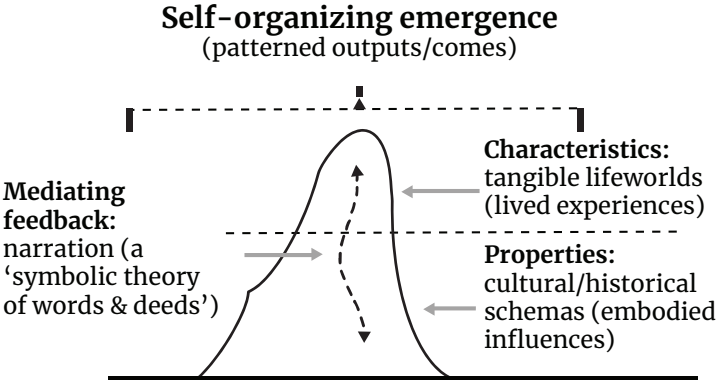

Figure 3. The Dynamics of an Anthropogenic System. Adapted from "Complex Adaptive HIV/AIDS Risk Reduction: Plausible Implications from Findings in Limpopo Province, South Africa," by C. J. Burman and M. Aphane, 2016, South African Medical Journal, 106(6), p. 571.

The visible characteristics of an anthropogenic system reflect tangible lifeworlds that people negotiate in variable ways. The submerged properties reflect historical, cultural schemas—including knowledge, rumor, and mythic schemas—which, collectively, have been described as a form of "sensori-memorabilia" (Burman, Mamabolo, Aphane, Lebese, & Delobelle, 2013, p. 22). The feedback within the system reflects how people make sense of the utility of the combination of both the characteristics (lived experience) and the properties (embodied schemas). Within anthropogenic systems, feedback typically manifests through narrative and storytelling, reflecting the "homo narrans" paradigm that describes narration as a "theory of symbolic actions—words and deeds—that have sequence and meaning for those who live, create, or interpret them . . . which has relevance to real as well as fictive worlds, to stories of living and stories of the imagination" (Fisher, 1984, p. 2).

In summary, during periods of stability, the dynamics of an anthropogenic system (the interactions of the properties and characteristics, mediated by feedback) produce patterned, stable emergence because the feedback is at a static equilibrium point. Periods of change, or transition, are typically catalyzed by an exogenous shock and represent systemic movement toward a far from equilibrium point due to changes within either the characteristics, the properties, or both, that alters the feedback dynamics. Resilience to exogenous shocks reflects the extent to which the influence of the change in either the characteristics or the properties—hence feedback—affects the overall functioning of the system. This basic understanding of the functioning of anthropogenic systems influenced the design of the taming wicked problems framework described below.

The Taming Wicked Problems Framework

The Framework has been through a number of iterations. Its current form is provided in Figure 4. The emphasis is movement within the metaphorical order/chaos continuum in order to stimulate and harness creative resilience strategies that can tame the growl of wicked problems.

The underlying rationale of the Framework was to catalyze ethical movement from ordered stasis—in this case, the deficit situation WWS had identified with regard to HIV risk reduction messaging—to a far from equilibrium position in order to stimulate bursts of creativity and possibly innovation as a first step toward taming the growl of the wicked problem. After the movement toward chaos, the ambition was to use a combination of scholarship and community-based project management strategies to identify nascent emergence that was of potential value to the partnership and, where possible, reinforce or dampen the emergent influences during the return journey toward order. The latter process was intended to ensure that the nascent emergence was embedded within the WWS system so that any creative, beneficent opportunities that had emerged during the period of destabilization could be harnessed and exploited by the partnership.

Defining the Project Boundaries: Agreeing on an End-Condition

At the beginning of the project it was impossible to predict what outputs were required to improve the HIV risk reduction messaging materials in the changing HIV and AIDS environment (the shift from ABC to 90-90-90). However, it was possible to agree on a set of parameters that the partnership could use to gauge progress by agreeing on an end-condition.

In this instance the agreed-on end-condition was influenced by the changes that the 90-90-90 strategy brought to the global/local HIV and AIDS environment. The ultimate goal of 90-90-90 is to reduce the aggregate global viral load to as low a level as possible. If this happened it would mean that of the people living with HIV today, very few could develop AIDS-related symptoms or be able to transmit HIV to another person. This biomedical logic provided a basis from which the partnership decided that during the project, any opportunity to reduce the aggregate *community* viral load would be considered a legitimate opportunity that could be used within the educational and awareness materials.

Systemic Destabilization Toward the Edge of Chaos: The Primary Probe

The word "probe" that is used to describe this phase of the Framework refers directly to Snowden and Boone's (2007) probe-sense-respond management strategy. The purpose of the primary probe is to begin the process of shifting the system from a close to equilibrium position—in this instance the deficit situation identified by WWS with

regard to HIV risk reduction messaging—toward a far from equilibrium position. In order to achieve this, the partnership identified a consultancy that specialized in HIV and AIDS training. The consultants' job was to provide a full account of the biomedical logic behind the global 90-90-90 strategy and to deliver the training in a participatory, iterative way to the senior management at WWS in order to catalyze movement toward a far from equilibrium position.

Systemic Reorganization: Discursive Spaces and Action Spaces

The systemic reorganization reflects the period during which the system absorbs the exogenous shock (in this instance, the information within the consultants' training materials) and begins to return from the edge of chaos back toward a new equilibrium point. The training (the primary probe) was a 2-day package, followed by a 2-day refresher 6 weeks later. The managers who attended the training agreed to critically discuss which aspects of the training they believed could be applied to their areas of work with their team members as a mechanism to increase the initial destabilization. These areas correspond to the "discursive spaces" shown in Figure 4.

There was no obligation to integrate any aspects of the training if the team members did not believe it would add value, but it was agreed that the managers would encourage their team members to use their intuition to identify components of the training that they believed would make sense to—and be effective among—their client constituencies. Based on these discussions, WWS then began safe to fail experiments to introduce the learning from the training into their working environment—the "action spaces" shown in Figure 4. Safe to fail experiments are premised on the argument that when undertaking experiments in unexplored territory, typically 50% of the experiments are likely to fail, but the collective learning from both the failures and the successes can catalyze the emergence of innovative practices (Ahern, 2011). In this instance, the purpose of the safe to fail experimentation was to accelerate and expand the participants' creativity while the system was at a far from equilibrium position on the metaphorical order/chaos continuum, as shown in Figure 5.

Safe to fail experiments—experiments that are low risk and will not create significant adverse impacts if they fail—are increasingly applied in wicked scenarios (Zivkovic, 2015). Because wicked scenarios rarely have a single solution, it is pragmatic to look for multiple resilience strategies that can co-contribute to achieving potentially beneficent change (Dickens, 2012). Undertaking a series of safe to fail experiments increases the variability (ideas and opportunities) within the system, thereby increasing the chances of identifying multiple opportunities to reduce the system's stuckness (Huertas, 2014). Based on the collective learning from the safe to fail experiments, WWS gradually refined the way that they used the materials provided by the trainers in their work.

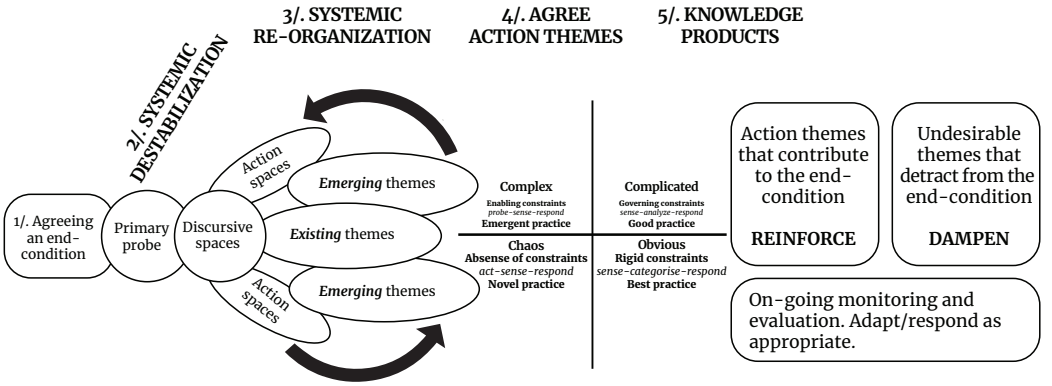

Figure 4. The Taming Wicked Problems Framework

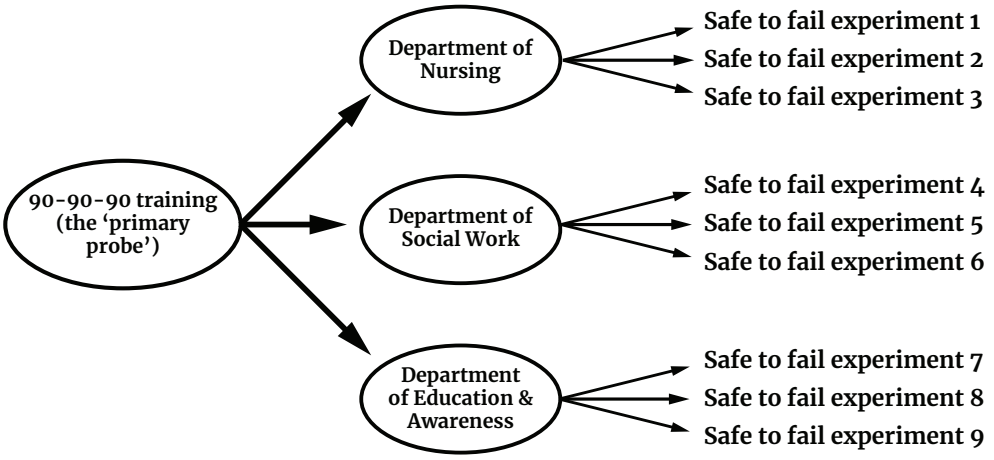

Figure 5. Multiple Safe to Fail Experiments Influenced by the 90-90-90 Training

Identifying Action Themes: Monitoring, Analyzing, and Evaluating the Systemic Reorganization

This phase in the Framework represents the "sense" in Snowden and Boone's (2007) probe-sense-respond management strategy. Sense making is typically understood to mean how organizations (Weick, 1995) or individuals (Dervin, 1998) make sense of the world so that they can act in it. The university component of the partnership agreed to take responsibility for the initial sensing of the emergent changes that would be validated by WWS at a later stage in the project. Three types of sense making enabled the themes to become visible and eventually to be refined into action themes.

Sense making (Phase 1): Community focus. During this period WWS and their client constituencies were undertaking safe to fail experiments and simultaneously making sense of the impacts. Throughout this period the university component of the partnership did not influence which aspects of the training were going to be applied by WWS, but they did visit regularly and undertake formal and informal discussions relating to the project. The monitoring focused on which components of the training WWS personnel believed would add value to their educational and awareness materials and the responsiveness of their client constituencies to the new materials—corresponding to the discursive spaces and action spaces shown in Figure 4. During this period it became evident that the movement from the equilibrium deficit situation toward chaos, as well as the subsequent reorganization toward a new close to equilibrium position, had involved what Brook, Pedler, Abbott, and Burgoyne (2015, p. 369) have described as "critical unlearning" of the information contained within the outdated ABC messaging among both WWS and their client constituencies. With time the unlearning gave way to reframing, as described by Goffman (1974), of the ABC influence in favor of the 90-90-90 strategy. These shifts were captured using conventional qualitative narrative collection techniques (recordings, note taking, translation, back translation, and so forth). Six months after the consultants' training, it was becoming evident from the qualitative findings that a saturation point was being reached, which suggested that the system was settling down into a new equilibrium position.

Sense making (Phase 2): Causal layered analysis (CLA). In order to identify potential themes, the university component of the partnership analyzed all of the qualitative data that had been collected during the interviews and discussions, using a qualitative methodology called causal layered analysis (CLA). CLA is associated with futures scientist Sohail Inayatullah, but an adapted CLA variation developed by community psychologists Bishop and Dzidic (2014) was applied. CLA is designed to provide a method for the "deconstruction and analysis of complex [anthropogenic] issues." The focus of CLA is the "[submerged] root of the issue" being scrutinized—as well as the surface

descriptors—so that opportunities "for genuine, transformative change to occur" may emerge (Bishop & Dzidic, 2014, p. 16).

Sense making (Phase 3): Partnership decision making. Once the interviews and discussions had been analyzed using the CLA method, feedback was presented to WWS at a 2-day decision-making dialogue. The purpose of the dialogue was to critically scrutinize the findings and make necessary adjustments prior to deciding which of the emergent themes would be focused on as action themes in the final stages of the project.

In order to identify the action themes that would be focused on, the following criteria were agreed on at the beginning of the dialogue. The action themes had to (1) contribute to reducing the aggregate community viral load; (2) be accompanied by some evidence that the emergent theme was producing some beneficent impacts in a reasonably predictable way (i.e., was showing signs of becoming ordered); (3) be themes that the client constituencies were repeatedly drawn to in a patterned way (i.e., the proposed action themes would not be random or ad hoc); and (4) require minimal resources to implement.

The dialogue was augmented by a joint analysis of the findings from the perspective of complexity using the Cynefin framework. The Cynefin framework (represented in the image underneath the words "agree action themes," Figure 4) has been applied in multiple projects involving anthropogenic complexity. The Cynefin framework was designed to enable decision makers to ascertain whether a particular challenge is ordered (linear), unordered (nonlinear), or contains combinations of both (Snowden & Boone, 2007). In this instance the findings of the CLA analysis were triangulated with the Cynefin framework in order to problematize, verify, and then consolidate evidence for the transition from emergent themes to action themes. Only themes that had moved from an unordered domain toward or into an ordered domain were considered to be legitimate potential action themes that would be focused on in the final phase of the project (Burman & Aphane, 2016c).

Agreeing on the Action Themes

Based on the outcomes of the multiple forms of sense making and the 2-day dialogue, three action themes were selected to be focused on, as shown in Figure 6: (1) the "origins of HIV"; (2) that "HIV, if treated using antiretroviral therapy, was now a chronic disease and not a death sentence"; and (3) the "viral load" (Burman & Aphane, 2016a). Other themes were identified that detracted from the end-condition, such as the influence of the broader community and stigma, but the partnership believed that at that stage these themes were outside their immediate control. Consequently, these themes were "parked" but monitored throughout for any change.

Rationale for the action themes. The partnership decided that three topics were important action themes for WWS and their client constituencies: (1) the "origins of HIV"; (2) "HIV, if treated using antiretroviral therapy, was now a chronic disease and not a death sentence"; and (3) the "viral load." The viral load and the transformation of HIV into a chronic disease, not a death sentence, dovetailed with the biomedical logic of the 90-90-90 strategy. However, the relevance of the origins of HIV was far more am-

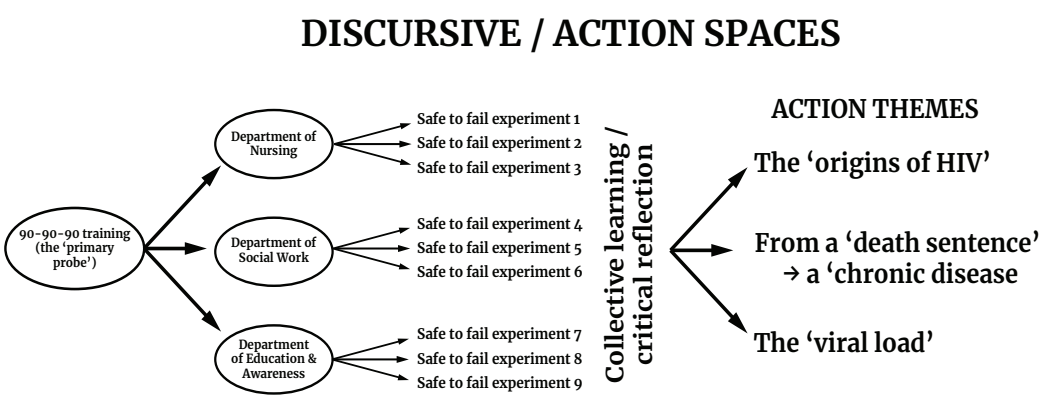

Figure 6. Identifying and Agreeing on Action Themes

biguous to the university component of the partnership and is worthy of more detailed explanation in order to provide context.

The origins of HIV: Some history. When WWS endorsed the origins of HIV action theme, the university component of the partnership requested clarification about why this theme was relevant. WWS's Education and Awareness Unit provided localised insights. (1) The origins of HIV—quite literally "where HIV originally came from"—is an issue that had been historically contested and debated by their client constituencies. (2) In the local language, Sotho-Tswana, the word *makgoma* is the name of a traditional disease that has similar symptoms to HIV-related coinfections, such as tuberculosis (Mabunda, Khoza, Van den Borne, & Lebese, 2016), and there is often confusion among the client constituencies as to whether particular symptoms are caused by HIV or makgoma. (3) The confusion between the origins of HIV and makgoma contributes to delays in testing for HIV and interruption of treatment among traditionalists in the area.

The localised conflation of HIV and makgoma reflects a phenomenon called *medical pluralism*. Medical pluralism reflects different understandings of disease causation which influences health-seeking behaviors (Dubois, 1961; Ibeneme, Eni, Ezuma, & Fortwengel, 2017). In the context of HIV and AIDS in eastern and southern Africa medical pluralism is associated with delays in HIV testing and the interruption of treatment (for a few examples see Kalichman & Simbayi, 2004; Leclerc-Madlala, Green, & Hallin, 2016; Moshabela et al., 2017; Pantelic et al., 2015; Shirindi & Makofane, 2015; Zuma, Wight, Rochat, & Moshabela, 2018). In Limpopo Province health care professionals also report that the high levels of nonadherence to antiretroviral therapy are "due to the use of traditional or alternative medicine" (SANAC, 2016, p. 77). The localised conflation of HIV and makgoma described by the Education and Awareness unit is one such manifestation of medical pluralism in South Africa which is reinforced by an excerpt from a local newspaper report:

> Culturally, we believe that you have makgoma (dirty blood) if your lover passes away, and if you don't get proper cleansing and rituals, anyone you sleep with will get so sick, and even have the same symptoms as someone with full-blown AIDS. So it is imperative to follow the correct rituals. (Disetlhe, 2014, quoting a representative from the National House of Traditional Leaders)

The impact of the action themes. Due to resource constraints, the partnership decided that the action themes would only be monitored in detail with WWS's Education and Awareness Department. By the end of 2015, the action themes had been firmly embedded within the educational and awareness materials that the Education and Awareness Department were using in deep rural areas with support groups for people living with HIV, many of whom were traditionalists. Initial findings from that monitoring indicated that combined use of the three action themes was opening spaces for critical dialogue relating to the client constituencies' personal experiences with HIV and treatment strategies. In turn, the dialogues and action themes were contributing to an increase in adherence to antiretroviral therapy and a decrease in internalized stigma among members of the support groups who were influenced by traditional values (Burman & Aphane, 2016b). Two years later, the action themes continue to have similar utility, and the information about the action themes has been requested by other support groups, indicating an increase in localized demand (Burman & Aphane, 2019).

From Action Themes to Knowledge Products

The partnership agreed that for an action theme to be developed into a knowledge product required that (1) there is empirical evidence that the theme either delivered or contributed to a tangible output, (2) the implementation strategy is low cost and replicable (i.e., ordered), and (3) there is sufficient external demand for the action theme to be developed into a financially viable product so that third stream income (i.e., income other than government funding and payments from students) can be generated from it. At the time of writing the action themes have been shown to achieve (1) and (2) but have not yet been developed into third stream income knowledge products.

Discussion

The discussion begins with a reflection on the metatheoretical positioning of the

taming wicked problems framework. This is followed by reflection on implementation-level issues that have emerged through the learning from this project.

A Metatheoretical Reflection

There has recently been a resurgence of interest in wicked problems in the context of shocks and resilience. It has been argued that wicked problems persist in part due to quasi-reductionist mind-sets that do not incorporate nonlinear dynamics into either the problem-framing or problem-solving efforts (Zywert & Quilley, 2017). Such mind-sets have been described as leading to a form of "technocratic tyranny" (Waltner-Toews, 2017, p. 1) enabled by the assumption, despite evidence to the contrary, that increased access to scientific information—implicitly derived through reductionist mind-sets—is the key ingredient required to tame the growl of wicked problems (Newman & Head, 2017).

The Framework was developed to put distance between the project design and the restrictive quasi-reductionist parameters that Zywert and Quilley (2017) and others have been critical of because—in the spirit of Pacanowsky (1995)—both anthropogenic systems and wicked problems contain some nonlinearity. In contradistinction, the Framework design set out from the premise that (1) anthropogenic systems contain both linear and nonlinear dynamics and (2) people, unlike machines, are capable of responding to a change in context (i.e., it is normal for anthropogenic systems to move within the metaphorical order/chaos continuum). Consequently, the Framework design aimed to maximize opportunities afforded by the naturalistic capabilities of anthropogenic systems (i.e., to move within the metaphorical order/chaos continuum) as a strategy to develop resilience to the wicked problem rather than to try and solve the problem.

Implementation-Level Reflections

The implementation-level reflections include brief statements about (1) the way that the Framework is designed to work with imperfect knowledge and serendipity, (2) the movement from global abstractions (the global 90-90-90 strategy) to social practices that make sense in particular localities, (3) the engaged values that developed during this project, and (4) the benefits that engaging with nonlinear complexity has brought to the partnership.

Negotiating imperfect knowledge and serendipity. Developing resilience strategies to the deficit situation relating to HIV risk reduction messaging that WWS identified required multiple journeys into Stacey's (2000, p. 92) "unknowable futures" by different project members within the metaphorical order/chaos continuum in pursuit of creativity and possible innovations. This necessarily required working with imperfect knowledge and exploiting emergent serendipitous opportunities if—and when—they occurred. Both imperfect knowledge and serendipity represent an essential, yet ambiguous, strategy for any type of engaged research. However, the Framework is implicitly hard-wired to reduce ambiguity using a series of filters because sense making—how people make sense of the world so they can act in it—was used to direct the early phases of the project. Figure 7 illustrates how the Framework incrementally filters abstract global knowledge toward a local level of granularity using a series of techniques that recursively constrain the global potentials toward local relevance.

At the beginning of the partnership, WWS was stuck at a self-proclaimed impasse—the "deficit situation" (Figure 7). At this point the system was close to equilibrium, with insufficient inputs to stimulate the levels of creativity required to catalyze change. The training—the primary probe—was designed to change the context and begin a process of moving the WWS system toward a far from equilibrium position in order to open creative spaces that would produce the basis for updated educational and awareness materials—and ultimately to aim for altered social practices. The training contained abstract, global biomedical knowledge about HIV and AIDS in the context of 90-90-90, as well as firsthand experiences (one of the trainers had been living with HIV for 32 years). The training prompted a shift in the systemic context from order toward chaos, and WWS responded with a combination of unlearning and reframing, which provided a basis from which they began to reimagine their working environment.

The initial constraint—the end-condition (a reduction in the aggregate community viral load)—was as abstract as the training, but it immediately moved the focus from global to local/community. From that point on—the destabilization, reorganization, and identification of action themes phases—the

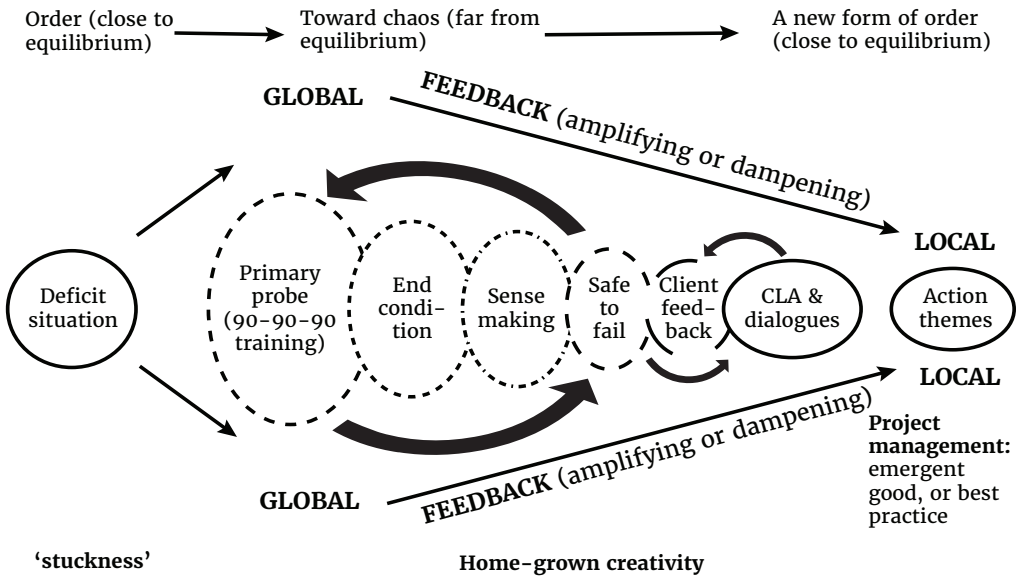

Figure 7. Facilitating and Managing Ambiguous Serendipity in a Wicked, Engaged Context

local/community abstraction was gradually further constrained though a series of iterative transitions defined to different levels of granularity by each of WWS's departments. These transitions were mediated by sense making during the safe to fail experimentation, ongoing dialogue and sharing of stories and information among participants, the causal layered analysis, and subsequent dialogue. It was also mediated by WWS's professional relationship with their client constituencies. These iterations both enabled and constrained the partnership to respond to empirical home-grown feedback—as opposed to expert-derived feedback—as it emerged. With each iteration the partnership gradually became increasingly focused toward localized relevance until the agreed-on action themes were selected. In order to emphasize this point, the following paragraphs revisit the "origins of HIV" action theme, using added details to demonstrate its relevance.

From global to local: Medical pluralism and the origins of HIV. Despite the use of imperfect knowledge and the adoption of serendipitous opportunities, the project moved from a global abstraction—the biomedical logic underpinning the 90-90-90 strategy introduced as the primary probe—through numerous iterations that have become consolidated into locally relevant social practices (a form of praxis). Movement from a global abstraction to localized social practices is relevant because many wicked problems originate from global sources but manifest in particular ways in different geographical settings (Taleb, 2007), so it is necessary to build locally relevant resilience to these types of global challenges (for an example of the importance of building local resilience to a global HIV epidemic, see Piot et al., 2015; Wilson & Halperin, 2008). The Framework was able to facilitate this movement from a global abstraction (medical pluralism) to localized social practices (an increase in adherence to antiretroviral therapy and a decrease in internalized stigma among traditionalists living with HIV) through the combination of the three action themes.

With the benefit of hindsight, the most plausible explanation for the utility of the Framework relates to feedback within the anthropogenic system. Behavioral change associated with anthropogenic systems is typically associated with adaptive or, on occasion, exaptive responses to exogenous shocks (Johnson, 2010). In this instance, the action themes that were identified by the partnership initially represented weak signals with only the potential to contribute to building resilience to the wicked problem. By rapidly reinforcing the weak signals during the return journey toward a new form of order, the Education and Awareness Department embedded the weak signal—the combination of action themes—as a legitimate concept with "sequence and meaning for those who live, create, or interpret them" among the support groups (Fisher, 1984, p. 2; Figure 8).

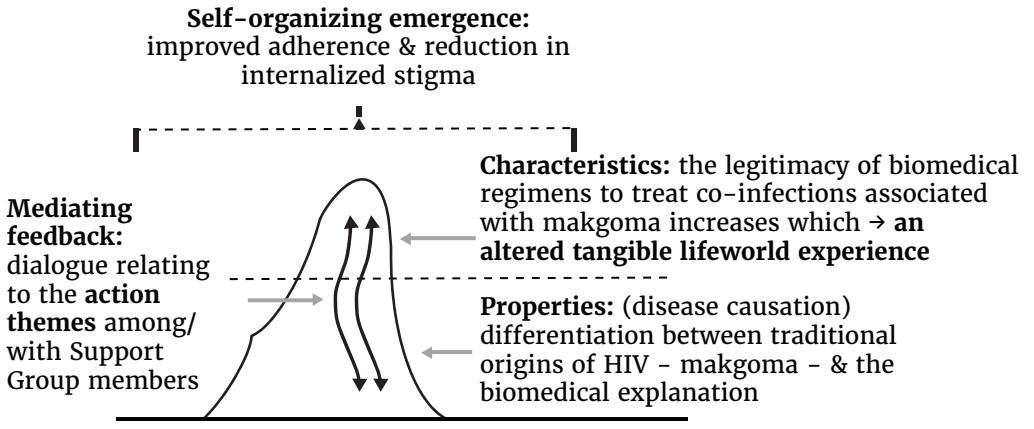

Figure 8. A Plausible Explanation of the Combination of Factors that Influenced the Change

From the perspective of the system dynamics that have been the focus of this article, this explanation seems plausible. However, far less certain—and, ultimately, far more relevant—is how the support group members received and responded to the change in their understandings about disease causation. This area of ambiguity will be investigated further, because if the intervention is to be shared it is likely to be a critical mediator of the potential utility of the action themes in other sociocultural contexts.

From global to local: The engaged values that facilitated the movement. Most texts relating to community engagement in South Africa include several descriptors concerning the relationship between academe and local communities that are becoming commonplace (horizontal relationships, coproduction of knowledge, mutually beneficial, responsiveness, joint decision-making, and so forth—for a synopsis see Beaulieu, Breton, & Brousselle (2018). In this instance, similar values developed. Table 1 describes the engaged values that emerged through the process of moving from a global abstraction to a locally defined level of granularity and associated shifts in social practices. The values that emerged were not a complementary add-on but a prerequisite for the partnership to reach its full potentials.

The benefits of engaging with nonlinear complexity. The primary benefit from the explicit attempt to incorporate both linear and nonlinear dynamics was the shift in the project leadership's mind-set from stuckness to creative potentials. At the level of theory, the implication was that as the WWS system was stuck within a deficit situation (a closed system with insufficient ideas), the first steps toward unblocking the stuckness required loosening the constraints on the system so it moved from being a closed system to being an open system in order to generate conditions that might enable new ideas to circulate. This required destabilization of the system toward the edge of chaos and then doing what could be done to manage the transition back to order by focusing on the emergent feedback within the system.

At a more pragmatic level, the attempt to incorporate both the linear and nonlinear dynamics enabled the project leadership to frame the project as an exploratory journey that would have to be negotiated, rather than an activity with a road map guided by scientific evidence. For example, recognizing that the WWS system was undertaking an exploratory journey into the unknown justified the use of sense making as the primary source of influential action clues used to focus the earlier phases of the project. Ensuring that sense making was applied as "making sense of the world so you can act in it" enabled the partnership to move from a global abstraction (the biomedical logic of 90-90-90) to localized social practices by following the logic of the action clues rather than relying on externally imposed best, or good, practices. The incorporation of both linear and nonlinear dynamics also justified the use of different facilitation techniques at appropriate moments during the project. Although, at first glance, the incorporation of both linear and nonlinear dynamics into

Table 1. Values Associated with Engaged Scholarship That Emerged During the Project

Phase	Values
1. Agreeing on an end-condition	Mutual refinement/agreement on the boundaries of the project = horizontal decision-making.
2. The training (primary probe)	The training prompted mutual unlearning, reframing, and eventually reimagining.
3. Sense making	Participation gave way to roles and responsibilities in that the university did not influence decision making during the systemic reorganization phases, which contributed to improved levels of trust within the partnership.
4. Safe to fail	Once again, the focus was on appropriate roles and responsibilities. Learning from the failures contributed to mutual unlearning and co-learning.
5. Client feedback	This was extremely important and reflects WWS's relationships with their client constituencies. Typically, prior relationships between a community partner and their client constituencies are rarely mentioned in engagement literature. In this instance, these relationships and the community network were critical mediators of the outputs during the project.
6. CLA	This says more about roles and responsibilities. The university students were able to use this exercise for academic purposes and the community did not become involved. It represented a mutual benefit for the partnership.
7. The community–university dialogue	The dialogue was open, honest, and focused. This reflects the relationships that had developed in the preceding months = co-decision-making.
8. Coproduction of knowledge products	The commitment to take the initiative further now represents a shared vision of the potentials of the findings and impacts of the engaged research.

the Framework design may seem slight, it did in fact "produce disproportionately major consequences" (to paraphrase Snowden & Boone, 2007, p. 71, once again).

Next Steps for the Partnership

The unintended adverse effects of traditionalism on the trajectory of the HIV and AIDS epidemic in South Africa have been documented since 2003 (Stadler, 2003), but to date there have only been fragmented, short-lived interventions designed to counter them (Leclerc-Madlala et al., 2016). Consequently, the current ambition of the partnership includes coproducing further empirical evidence to determine whether the action themes can be transferred into interventions in other districts and provinces. It is also hoped that knowledge products can be developed that will provide third stream income for the partnership.

Conclusion

The ambition of the project was to develop a framework that would provide the partnership with the agility to work with anthropogenic complexity, rather than try and fit mechanistic models underwritten by reductionism into wicked contexts. In the context of resilience, the taming wicked problems framework was found to be fit for the purpose. The partnership has not

solved all of the problems, but resilience to aspects of the problems has developed. It is believed that the system-level focus—one that was inclusive of both linear and non-linear system dynamics—is a functional addition to engaged research in the context of building resilience to wicked problems that could have utility in other disciplinary spheres.

Acknowledgments

This reflection represents learning from research activities supported by the National Research Foundation (NRF; Grant Number 82628) which were undertaken in partnership with the Waterberg Welfare Society (WWS). Any opinion, finding, and conclusion or recommendation expressed in this material is that of the author; the NRF and WWS do not accept any liability in this regard.

About the Author

Chris Burman *is a senior lecturer with the Masters in Development programme at the Turfloop Graduate School of Leadership (TGSL) at the University of Limpopo, South Africa. His research interests include engaged scholarship and applications of nonlinear dynamical theory to complex, community–university challenges. He received a Ph.D. in development studies from the University of the North.*

References

Ahern, J. (2011). From *fail-safe to safe-to-fail*: Sustainability and resilience in the new urban world. *Landscape and Urban Planning, 100*(4), 341–343. doi:10.1016/j.landurbplan.2011.02.021

Australian Public Service Commission. (2007). *Tackling wicked problems: A public policy perspective*. Canberra, Australia: Author. Retrieved from http://www.enablingchange.com.au/wickedproblems.pdf

Bayer, R. (2014). The medicalization of HIV prevention: New opportunities beset by old challenges. *Milbank Quarterly, 92*(3), 434–437. doi:10.1111/1468-0009.12070

Beaulieu, M., Breton, M., & Brousselle, A. (2018). Conceptualizing 20 years of engaged scholarship: A scoping review. *PloS One, 13*(2), 1–17. doi:10.1371/journal.pone.0193201

Bishop, B. J., & Dzidic, P. L. (2014). Dealing with wicked problems: Conducting a causal layered analysis of complex social psychological issues. *American Journal of Community Psychology, 53*(1–2), 13–24. doi:10.1007/s10464-013-9611-5

Brook, C., Pedler, M., Abbott, C., & Burgoyne, J. (2015). On stopping doing those things that are not getting us to where we want to be: Unlearning, wicked problems and critical action learning. *Human Relations, 69*(2), 369–389. doi:10.1177/0018726715586243

Brown, V. A., Harris, J., & Russell, J. (2010). *Tackling wicked problems through the transdisciplinary imagination*. London, England: Earthscan.

Burman, C. J., & Aphane, M. (2016a). Community viral load management: Can "attractors" contribute to developing an improved bio-social response to HIV risk-reduction? *Nonlinear Dynamics, Psychology, and Life Sciences, 20*(1), 81–116.

Burman, C. J., & Aphane, M. (2016b). Complex adaptive HIV/AIDS risk reduction: Plausible implications from findings in Limpopo Province, South Africa. *South African Medical Journal, 106*(6), 571–574. doi:10.7196/SAMJ.2016.v106i6.10255

Burman, C. J., & Aphane, M. A. (2016c). Leadership emergence: The application of the Cynefin framework during a bio-social HIV/AIDS risk-reduction pilot. *African Journal of AIDS Research, 15*(3), 249–260. doi:10.2989/16085906.2016.1198821

Burman, C. J., & Aphane, M. (2019). Improved adherence to antiretroviral therapy among traditionalists: Reflections from rural South Africa. *African Health Sciences, 19*(1), 1422–1432. doi:10.4314/ahs.v19i1.15

Burman, C. J., Aphane, M., & Mollel, N. (2017). The taming wicked problems framework: Reflections in the making. *Journal for New Generation Sciences, 15*(1), 51–73.

Burman, C. J., Mamabolo, R., Aphane, A., Lebese, P., & Delobelle, P. (2013). The South African developmental landscape: Restricted potentials or expansive, complex adaptive opportunities? *The Journal for Transdisciplinary Research in Southern Africa, 9*(1), 17–37. doi:10.4102/td.v9i1.216

Chaffin, B. C., & Gunderson, L. H. (2016). Emergence, institutionalization and renewal: Rhythms of adaptive governance in complex social-ecological systems. *Journal of Environmental Management, 165*, 81–87. doi:10.1016/j.jenvman.2015.09.003

Churchman, C. W. (1967). Wicked problems. *Management Science, 14*(4), B-141–B-146. doi:10.1287/mnsc.14.4.B141

de Beer, S. (2014). Reimagining the third sector and its engagement with higher education. In M. Erasmus & R. Albertyn (Eds.), *Knowledge as enablement: Engagement between higher education and the third sector in South Africa* (pp. 119–141). Bloemfontein, South Africa: SUN MeDIA.

Dervin, B. (1998). Sense making theory and practice: An overview of user interests in knowledge seeking and use. *Journal of Knowledge Management, 2*(2), 36–46. doi:10.1108/13673279810249369

Dickens, P. M. (2012). *Facilitating emergence: Complex, adaptive systems theory and the shape of change* (Unpublished doctoral thesis). Antioch University.

Disetlhe, K. (2014, November 8). The curse of being a nyatsi—lover's blood also needs to be cleansed. *The Sowetan* [Internet edition]. Retrieved from http://www.sowetanlive.

co.za/entertainment/2014/11/08/the-curse-of-being-a-nyatsi---lover-s-blood-also-needs-to-be-cleansed

Dubois, R. (1961). *The mirage of health: Utopias, progress and biological change*. New York, NY: Anchor Books.

Dunn, G., Brown, R. R., Bos, J. J., & Bakker, K. (2016). Standing on the shoulders of giants: Understanding changes in urban water practice through the lens of complexity science. *Urban Water Journal, 14*(7), 758–767. doi:10.1080/1573062x.2016.1241284

Fisher, W. R. (1984). Narration as a human communication paradigm: The case of public moral argument. *Communication Monographs, 51*(1), 1–22. doi:10.1080/03637758409390180

Gladwell, M. (2000). *The tipping point: How little things can make a big difference*. Boston, MA: Little Brown.

Goffman, E. (1974). *Frame analysis: An essay on the organization of experience*. Cambridge, MA: Harvard University Press.

Healey, P. (2007). Relational complexity and the imaginative power of strategic spatial planning. *European Planning Studies, 14*(4), 525–546. doi:10.1080/09654310500421196

Huertas, T. F. (2014). *Safe to fail: How resolution will revolutionise banking*. London, England: Palgrave Macmillan.

Ibeneme, S., Eni, G., Ezuma, A., & Fortwengel, G. (2017). Roads to health in developing countries: Understanding the intersection of culture and healing. *Current Therapeutic Research, Clinical and Experimental, 86*, 13–18. doi:10.1016/j.curtheres.2017.03.001

Johnson, S. (2010). *Where good ideas come from: The seven patterns of innovation*. New York, NY: Riverhead Books.

Joint United Nations Programme on HIV/AIDS (UNAIDS). (2014). *Fast track: Ending the AIDS epidemic by 2030*. Geneva, Switzerland: Author. Retrieved from http://www.unaids.org/sites/default/files/media_asset/JC2686_WAD2014report_en.pdf

Kalichman, S. C., & Simbayi, L. (2004). Traditional beliefs about the cause of AIDS and AIDS-related stigma in South Africa. *AIDS Care, 16*(5), 572–580.

Kauffman, S. (2005). *At home in the universe: The search for laws of self-organization and complexity*. New York, NY: Oxford University Press.

Leclerc-Madlala, S., Green, E., & Hallin, M. (2016). Traditional healers and the "fast-track" HIV response: Is success possible without them? *African Journal of AIDS Research, 15*(2), 185–193. doi:10.2989/16085906.2016.1204329

Lorenz, E. (1972, December 29). *Predictability: Does the flap of a butterfly's wings in Brazil set off a tornado in Texas*. Paper presented at the American Association for the Advancement of Science, Washington, DC.

Mabunda, J. T., Khoza, L. B., Van den Borne, H. B., & Lebese, R. T. (2016). Needs assessment for adapting TB directly observed treatment intervention programme in Limpopo Province, South Africa: A community-based participatory research approach. *African Journal of Primary Health Care and Family Medicine, 8*(2), e1–7. doi:10.4102/phcfm.v8i2.981

Mertens, D. M. (2015). Mixed methods and wicked problems. *Journal of Mixed Methods Research, 9*(1), 3–6. doi:10.1177/1558689814562944

Moshabela, M., Bukenya, D., Darong, G., Wamoyi, J., McLean, E., Skovdal, M., . . . Wringe, A. (2017). Traditional healers, faith healers and medical practitioners: The contribution of medical pluralism to bottlenecks along the cascade of care for HIV/AIDS in Eastern and Southern Africa. *Sexually Transmitted Infections, 93*(Suppl. 3), e1–5. doi:10.1136/sextrans-2016-052974

Mostert, J. W., & Van Heerden, J. H. (2015). A computable general equilibrium (CGE) analysis of the expenditure on infrastructure in the Limpopo economy in South Africa. *International Advances in Economic Research, 21*(2), 227–236. doi:10.1007/s11294-015-9524-1

National Department of Health. (2015). *The 2013 National Antenatal Sentinel HIV Prevalence*

Survey, South Africa. Pretoria, South Africa: Author. Retrieved from https://health-e.org.za/wp-content/uploads/2016/03/Dept-Health-HIV-High-Res-7102015.pdf

Newman, J., & Head, B. W. (2017). Wicked tendencies in policy problems: Rethinking the distinction between social and technical problems. *Policy and Society, 36*(3), 414–429. doi:10.1080/14494035.2017.1361635

Pacanowsky, M. (1995). Team tools for wicked problems. *Organizational Dynamics, 23*(3), 36–51. doi:10.1016/0090-2616(95)90024-1

Pantelic, M., Cluver, L., Boyes, M., Toska, E., Kuo, C., & Moshabela, M. (2015). Medical pluralism predicts non-ART use among parents in need of ART: A community survey in KwaZulu-Natal, South Africa. *AIDS and Behavior, 19*(1), 137–144. doi:10.1007/s10461-014-0852-6

Pincus, D., & Metten, A. (2010). Nonlinear dynamics in biopsychosocial resilience. *Nonlinear Dynamics, Psychology, and Life Sciences, 14*(4), 353–380.

Piot, P., Abdool Karim, S. S., Hecht, R., Legido-Quigley, H., Buse, K., Stover, J., . . . Sidibé, M. (2015). Defeating AIDS—advancing global health. *The Lancet, 386*(9989), 171–218. doi:10.1016/s0140-6736(15)60658-4

Ramalingham, B. (2013). *Aid on the edge of chaos*. Oxford, England: Oxford University Press.

Rickles, D., Hawe, P., & Shiell, A. (2007). A simple guide to chaos and complexity. *Journal of Epidemiology and Community Health, 61*(11), 933–937. doi:10.1136/jech.2006.054254

Sharts-Hopko, N. C. (2013). Tackling complex problems, building evidence for practice, and educating doctoral nursing students to manage the tension. *Nursing Outlook, 61*(2), 102–108. doi:10.1016/j.outlook.2012.11.007

Shirindi, M., & Makofane, M. (2015). Ritual impurities: Perspectives of women living with HIV and AIDS. *African Journal for Physical, Health Education, Recreation and Dance, 21*(3.2), 941–952.

Snowden, D. J., & Boone, M. E. (2007). A leader's framework for decision making. Harvard Business Review, 85(11), 68–76.

Stacey, R. (2000). How the complexity sciences deal with the future. In D. Griffin, R. D. Stacey, & P. Shaw (Eds.), *Complexity and management: Fad or radical challenge to systems thinking?* (pp. 85–105). New York, NY: Routledge.

South African National AIDS Council. (2016). *Enhanced progress report: National Strategic Plan on HIV, STIs and TB (2012–2016)*. Pretoria, South Africa: Author. Retrieved from https://sanac.org.za/download/563/resources/3393/epr-sanac-new-doc-latest-update3.pdf

South African National AIDS Council. (2017). *The South African National Strategic Plan for HIV, TB and STIs 2017–2022* (1). Pretoria, South Africa: Author. Retrieved from https://sanac.org.za/download-the-full-version-of-the-national-strategic-plan-for-hiv-tb-and-stis-2017-2022-2/

Stadler, J. (2003). Rumor, gossip and blame: Implications for HIV/AIDS prevention in the South African lowveld. *AIDS Education and Prevention, 15*(4), 357–368.

Taleb, N. N. (2007). *The black swan: The impact of the highly improbable*. New York, NY: Random House.

Waltner-Toews, D. (2017). Zoonoses, One Health and complexity: Wicked problems and constructive conflict. Philosophical Transactions of the Royal Society of London. *Series B: Biological Sciences, 372*(1725). doi:10.1098/rstb.2016.0171

Waterberg Welfare Society. (2017). Waterberg Welfare Society (WWS). Retrieved from http://www.waterbergwelfaresociety.org.za/

Weick, K. (1995). *Sensemaking in organizations*. Thousand Oaks, CA: Sage.

Wilson, D., & Halperin, D. T. (2008). "Know your epidemic, know your response": A useful approach, if we get it right. *The Lancet, 372*(9637), 423–426. doi:10.1016/s0140-6736(08)60883-1

Zivkovic, S. (2015). A complexity based diagnostic tool for tackling wicked problems. *Emergence: Complexity & Organization, 17*(4), 1–12. Retrieved from https://

www.researchgate.net/profile/Sharon_Zivkovic2/publication/292462726_A_complexity_based_diagnostic_tool_for_tackling_wicked_problems/links/5785b7b008aec5c2e4e12196.pdf doi:10.emerg/10.17357.6fe617a27bf4628733eb114de16b301b

Zuma, T., Wight, D., Rochat, T., & Moshabela, M. (2018). Navigating multiple sources of healing in the context of HIV/AIDS and wide availability of antiretroviral treatment: A qualitative study of community participants' perceptions and experiences in rural South Africa. *Frontiers in Public Health, 6*, 1–14. doi:10.3389/fpubh.2018.00073

Zywert, K., & Quilley, S. (2017). Health systems in an era of biophysical limits: The wicked dilemmas of modernity. *Social Theory & Health, 16*(2), 188–207. doi:10.1057/s41285-017-0051-4