

Article

Apithology Systems Inquiry: Evaluation from a Generativist Ontology

Will Varey

Centre for Humanity Learning, PO Box 167, Albert Park, Victoria 3206, Australia;
will@apithologia.com; Tel.: +61-8946-74455

Academic Editors: Shankar Sankaran, Pamela Buckle Henning, Timothy Ferris and Mary C. Edson
Received: 30 December 2016; Accepted: 28 February 2017; Published: 2 March 2017

Abstract: The ontological premise of a systems research philosophy raises some unique questions about research efficacy. The study of the relations between abstract objects in bounded contexts places systems inquiry into a specific research category. Different systems research paradigms deal with the question of research evaluation distinctively. This article examines the defining criteria for the evaluation of systems research within a generativist systems ontology. Three criteria to inform the design of generativist systems research are proposed. Their use is illustrated for the generativist systems research discipline of apithology. The proposed criteria of research validity, credibility and reliability generate a fourth criterion: systems research veracity. A heuristic for discerning the results of a generativist research design prior to its commencement is provided by an apithology triptych. The benefit of this approach is to enable the design of research of relevance, significance and importance that leads naturally to apithology systems research of consequence.

Keywords: systems inquiry; ontology; abductive logic; generative systems; apithology

1. Introduction

The history of the philosophy of science reflects a pragmatic balance between the horizons of doubt and belief [1]. The foundations of traditional research accepted the ontological premise of scientific knowledge as the confirmation of the existent [2]. To fulfill this aim, formal science sought methods for the verification of propositions by logical analysis [3]. More speculative conjectures were subject to challenges to their validity, while recognizing the finite nature of knowledge and the movement towards more mature forms of discovery [4]. The examination of different research questions necessarily involved the formation of compatible paradigms to generate meaningful answers that were consistent, confirmable and commensurable with the principles of normal science [5]. More recent innovations in research methods have prompted the delineation and clarification of the criteria by which new forms of research are to be evaluated [6].

In contrast to this trajectory, one contribution of general systems theory and systems research generally was to offer an ontological redirection of attention in scientific inquiry [7]. Instead of static and unconnected occurrences, general systems principles allowed for dynamically related dependencies, in hierarchies of complexity, involving multiple scenarios of contingencies to be examined specifically [8]. This required distinctively different competencies from systems researchers; in the selection of the phenomenon for observation, the adoption of distinctive systems heuristics, and a tolerance for ambiguity in the conceivable scenarios modeled [9]. The foundational premise of a systems philosophy notably changed the basis for undertaking sound scientific research [10].

This article extends the considerations of standards in systems research by reporting on one area of systems research evaluation within a generativist systems ontology. In a generativist ontology the phenomenon of interest is of a different systemic order, primarily examining phenomena comprising

the prospective, the multi-temporal and not-yet-existent [11]. More specifically, the content of reality considered includes the formative dynamics of combinational resultants, the trajectory of generative potentials, and the enabling conditions for a sequence of integrative transitions. Rather than quantifying definitive objects, or specifying defined relations, a generativist systems research premise instead proposes an ontology of possibilities, within discernible systems of entrainments and potentialities [12]. Traditional research standards, and general systems principles, should inform the philosophy and overall design of any systems research [13]. It is argued that due to the distinctive differences in epistemological emphasis for research inquiries grounded specifically in a generativist ontology, more appropriate evaluation criteria may be required to guide the execution of that research in practice.

This article contributes a consideration of the research requirements of one form of systems research by asking the question: *What criteria might be used to evaluate standards of research efficacy in a generativist systems ontology?* To examine this question, this article first provides background on the practical needs in apithology systems inquiry, clarifies the distinctions of a generativist systems ontology, delineates the proposed generativist research evaluation criteria, considers how research veracity is formed conjunctively, and provides the illustration of a practical approach to evaluation as used in apithology systems inquiry. The article concludes with reflections on the research and praxis implications of this study.

2. Apithology Systems Inquiry

The discipline of apithology is one type of generativist systems inquiry formed for a specific purpose. Its research premise prompts investigation of the formative potentials of generative systems and the dynamics enabling systemic sufficiency. Specifically, apithology systems inquiry considers the dynamics of the presently nascent, looking not only at the presently occurring, but also at the potentially formative. The benefit of apithology research is that it allows for another approach to social contribution, looking not just at problems in existing functions, but examining the foundation for new causations. This focus requires a different basis for the formation of epistemological rigor, requiring of the apithology researcher different methodological necessities, processes for achieving efficacy, and distinctive system research competencies.

These research requisites have developed over time as a matter of practical necessity. This is illustrated by a brief history of the development of apithology systems inquiry as a research discipline. The sequence of its elucidation includes statements of the initial developmental theory [14], the basic ontological precepts [15], the premise of its epistemology [16], the formalization of a taxonomy [17], the genealogy of its praxis [18], the axiology of its research aesthetics [19], the praxeology of systemic interventions [20], and the formation of learning heuristics to guide reflexive practice [21].

However, while the practical applications of the theory have sought to be expansive [22], the criteria for its research evaluation had remained (until now) speculative. The natural extension of systems research principles to this field identified the potential for disciplinary rigor in the development of this particular form of systems research praxis [23]. This article examines the practical implications of doing research within the ontology of the generativist systems paradigm, with reference to the specific application of apithology systems inquiry. This application of systems research principles informs the practical steps needed for proficiency in conducting apithology systems research. A first step to that aim is to examine how a generativist systems inquiry comprises a distinct form of research.

3. Generativist Systems Ontology

The premise of a generativist approach to research questions can be contrasted with other systems research approaches (including research into “generative systems” generically). To illustrate the distinctive questions asked from a generativist systems paradigm, it is useful to consider differences in ontological focus, epistemological aims, and methodological necessities. As three notional points of comparison, we might highlight the different research ambitions of: (a) *formal research*; (b) *systems*

research; and (c) *generativist systems research*. Each has different tests for the establishment of research sufficiency which logically result from the different emphasis on the phenomenon of primary interest in their respective forms of inquiry.

In *formal research*, a consequentialist approach to the hypothetico-deductive method derives its research questions from the premise of explanation by description [24]. This approach fully explains the question of what has happened, observing correctly a specific thing with exactness. This leaves mostly unanswered the question of why there is that circumstance and not another. The product of this type of formal research analysis is a finding of a specific or generalizable truth that is replicable and predictable.

In *systems research*, there is the possibility to examine other scenarios possible from the same conditions, to look predictively at how variables in a system of relations may result in different occurrences [25]. This highlights a shift from the observable and specific to the contextual and dynamic. The product of a systems analysis is often the explanation of the occurrence of more than one resulting circumstance.

In *generativist systems research*, the premise alters to examine not the possibilities of the existent, but the potentialities of the prospective. This involves the analysis of the formative conditions for generative potentials in a phase space of possible transitions [26]. This is a shift from describing possible system dynamics, to deriving the potentials for dynamic generative systems. The product of a generativist systems analysis is the appreciation of the trajectory of enabling potentials, that form systems of other potentialities.

In summary, a generativist systems ontology looks directly at the potential of systems in the processes of formation. It is concerned with different phenomena ontologically, constituting meaningful yet unfamiliar paradigmatic realities. Specifically, its epistemology requires examination of constraint parameters, trajectories of development, systemic state transitions, developmental integrations, enabling conditions, and actuation thresholds. Ideally, this requires the same level rigor as a formalist research approach, except that its ontological content is not evidence of the occurred, but rather the potential for actuations. As a distinctively different phenomenological ontology, this generates subtly different questions of research efficacy.

Due to this ostensibly different focus of attention, a different premise for evaluation is required for any generativist systems research analysis. Given the speculative (or rather prospective) form of generativist systems depictions, the appropriate criteria for evaluation of research forming a generativist systems inquiry may be informed by, yet is different to, other research requirements.

4. Evaluating Research Efficacy

A strength of the systems research field is that it extends across multiple knowledge domains and paradigms of practice. A difficulty for the systems researcher is to meet the specific research standards that the various domains of systems research may be conducted within. For the novice (or novel) researcher, the difficulty of appreciating the fine distinctions in research standards (and their applied nuance in specific paradigms) is heightened by the abstract content that systems research often considers.

For example, in quantitative research (i.e., involving deductive, objective, or positivist research assumptions) the primary evaluative test is for “validity” (including the applied and defined criteria of *replicability*, *repeatability*, *reproducibility* [27], *generalizability* [28], *precision*, *accuracy* and *stability* [29]). In the qualitative discipline (i.e., involving inductive, inter-subjective, or constructivist research assumptions), traditional tests are refuted and research adequacy may instead emphasize “credibility” (including the applied and defined criteria of *trustworthiness* [30], *consistency*, *dependability* [31], *convergence*, *understanding* [32] *descriptiveness* and *authenticity* [33]). In the qualiatative paradigm (i.e., involving abductive, subjective, or nominalist research assumptions), adequacy tests instead emphasize “reliability” (including the applied and defined criteria of *comprehensiveness*, *reasonableness*, *meaningfulness* [34], *coherence*, *resonance*, *elegance* [35], and *reflexivity* [36]). For specific disciplines,

the argument for appropriate evaluation criteria (e.g., cultural fit, appropriateness, and effectiveness in design) is well made [37]. In cross-disciplinary and multi-disciplinary work, the tyranny of inappropriately attributed taxonomic standards may be avoided by making clear distinctions about the emphasis of the research.

The emphasis of this paper focuses not on re-defining foundational concepts of validity, but rather on meeting the practical aim of attaining generativist research “efficacy”, with the research process being undertaken systematically and producing its intended result of providing the opportunity for a worthwhile contribution to knowledge. This ethic of prospective contribution is what principally guides a generativist research formulation in the advancement of humanity knowing.

To prompt a further comparison of how research efficacy is approached in different domains, an illustrative distinction can be made between the ontological emphasis of formal research, systems research and generativist systems research. By way of example of this difference in emphasis, in *formal* research the isolation of factors, the examination of discrete elements, and the study of particulars will provide replicable exactness. In *systems* research, the description of relations between system elements, within a whole system, governed by dynamic variables, within systemic boundaries, may provide predictive insights. In *generativist systems* research, the investigation of enabling conditions, the appreciation of generative potentials, and the elucidation of coherences in formative resultants potentially envisages prospective landscapes. Each has its own adequacy of precision, directed towards a different scope of phenomena (or ontological content), while aiming for different research outcomes.

Because a generativist ontology has a philosophical premise that human knowledge is in a constant process of formation and reformulation, the efficacy of its research inquiry is less about the exactness of present knowings and is more concerned with how future research will fulfill desired knowledge aims and outcomes. With an assumption of knowledge humility, new forms of research inquiry can still be designed with outcome specificity, only differently. Rather than attempting to be definite, generativist research is definitive; rather than aiming to be irrefutable, it seeks to be representative; and rather than seeking to be conclusive, its value is in allowing for the prospective. The ambition of a generativist inquiry is to provide a valid depiction of what is knowable and (more importantly) a viable platform for what makes future knowing more knowledgeable. From the premise of the contribution to humanity knowing, this prompts the elucidation of the evaluation criteria specific to generativist systems research in fulfilling its intended research aims.

5. Generativist Research Criteria

The premise of a generativist systems research philosophy is that an inquiry has benefit if it can be used to advance future knowledge and knowing distinctively (and its potentials demonstrably). Good research within this domain is not only satisfying in ways that are personally affirming, or undertaken well so as to be considered paradigm confirming, but must specifically enable future humanity knowing. The evaluative tests for sufficiency in generativist research are notably different, while still being consistent with wider systems philosophy concepts and general principles of research efficacy. As with any research paradigm, the criteria for evaluation must eventually be defined (or at least explored) [38]. Being a different research context, some familiar research concepts will have different definitions and contextual meanings in this instance. As the attribution of familiar meanings to this unfamiliar context will evidence the absences, confusions and conflation that this article seeks to redress, a brief elucidation is provided for clarity of these specific concepts as they are applied to generativist research sufficiency.

5.1. Validity (Inclusivity)

The first component of sufficiency in research comprising a generativist systems inquiry is *validity*. In this context, the test of validity concerns the extent of the research. This asks the question: *Is the extent of the conclusions made consistent with the scale of the observations undertaken?* In complex systems of multiple levels of organization, with each level involving different types of phenomenon, sound

systems research makes observations that are specific to the scale of the inquiry, while also recognizing external systemic dependencies [39]. In a continuum of choice between the specific and the expansive, the appropriate research is one that makes definitive choices as to inclusivity. The purpose of the research is to include all that is relevant. The contribution of research that meets the first test of sufficiency is that it provides information that is “true”.

5.2. Credibility (Mutuality)

The second component of sufficiency in research comprising a generativist systems inquiry is *credibility*. In this context, the test of credibility concerns the authority of the research. This asks the question: *Does the determination of the factual and the interpretation of the actual accurately represent the situation inquired into?* In systems inquiry, there is often a blend of quantitative and qualitative elements. There may be a choice between research methods that rely on measurement and/or narrative depending on the research context and objectives [40]. The role of good systems research is to use methods appropriate to the emphasis in the inquiry. In a continuum of choice between the quantitative and the interpretative, the appropriate research is one that makes satisfactory choices as to mutuality. The purpose of the research is to find everything that has significance. The contribution of research that meets the second test of sufficiency is that it provides information that is “trustworthy”.

5.3. Reliability (Maturity)

The third component of sufficiency in research comprising a generativist systems inquiry is *reliability*. In this context, the test of reliability concerns the consistency of the research. This asks the question: *Does the research provide for confirmation of existing knowns and the exploration of future unknowns with equal proficiency?* In systems research, there is, in practice, a conjunction of theory and method. The extension of a new theory relies on an existing method, and the examination of new data relies on an existing theory [41]. The role of good systems research is to use a process that is appropriate to the exactness of knowing required of the inquiry. In a continuum of choice between the existent and the expectant, the appropriate research is one that makes reflexive choices as to knowledge maturity. The purpose of the research is to ask about everything that has importance. The contribution of research that meets the third test of sufficiency is that it provides information that is “truthful”.

5.4. Research Sufficiency (Veracity)

In summary, research that: (a) does not use a valid method of observation; (b) cannot credibly be confirmed by its paradigm of enaction; or (c) examines questions of speculation using assumptions without foundation, may arguably not ever be sufficient in terms of generative enablement. While wide forms of research are acceptable in various paradigms of inquiry simply by demonstrating the actions of research, such contributions to knowledge may not be sufficient in contributing generatively to future humanity knowing. These proposed tests of generativist sufficiency (as defined) are not necessarily appropriate (and are not usually required) for other paradigms of scientific or systemic inquiry. By contrast, the combination of the three research criteria of validity, credibility and reliability (as defined) is mandatory in the premise of apithology research. When each criterion is combined together, the result provides a distinctive benefit. This is described in apithology systems inquiry as constituting research *veracity*.

6. Apithological Veracity

The requirement for research veracity forms the basis for evaluation of sufficiency in apithology systems inquiry. This additional criteria distinguishes apithology systems inquiry from other forms of generativist systems research. The word “veracity” colloquially means “... the quality (or habit) of being true, honest and accurate” [42]. The technical definition of veracity in the practice of apithology systems inquiry has the precise meaning of comprising research that has a high probability of meeting

all three criteria of sufficiency, conjunctionally. The resultants of these conjunctive elements comprise the tests for sufficiency in an apithology systems inquiry.

The three criteria for apithology systems sufficiency form part of a matrix of dynamics in an apithology epistemology. These dynamics can be seen as the corresponding components in five dimensions, which are described as: (a) the criteria for sufficiency; (b) the continua of selection; (c) the basis for evaluation; (d) the aesthetic quality of beauty; and (e) the virtue provided to humanity (see Table 1). Although conjunctive, each dimension can be explained and understood separately, by being seen as signifiers within a complex of meaning (as a totality).

Table 1. Apithology systems inquiry: Evaluation dimensions.

Dimension	Firstness	Secondness	Thirdness	Resultant ¹
Criteria	Validity	Credibility	Reliability	Veracity
Continua	Inclusivity	Mutuality	Maturity	Potentiality
Evaluation	Relevance	Significance	Importance	Consequence
Quality	Specificity	Honesty	Acceptability	Receptivity
Virtue	True	Trustworthy	Truthful	Trusted

¹ The resultant for each dimension is the product of a generative trichotomy of its correlates.

The dimension of *Criteria* has already been outlined in detail in Section 5. This relates to the sufficiency of the research inquiry. The dimension of *Continua* specifies the dilemma in research selection, ensuring the research is inclusive in scope, confirmable by its community, and adequately developed in its hypotheses. The dimension of *Evaluation* describes the result that is aimed for, with the research having relevance to its topic, significance to its academic community, and importance in a developing trajectory of inquiry. The dimension of *Quality* is the standard of the 'good' as a social valuing of the inquiry by its specific applications, humble provocations, and acceptable extrapolations. The dimension of *Virtue* illuminates the actual contribution to humanity knowing, affirming how knowledge that is accurate, confirmable, and conceivable may be beneficially relied upon.

In summary, an apithology research premise is met when research that has *validity*, *credibility* and *reliability* conjunctively enables research *veracity*. When designing apithology research the intention is to satisfactorily resolve possible conflicts between; the specific and the general (*inclusivity*), the empirical and sociological (*mutuality*), and the known and the unexplored (*maturity*). In the evaluation of such research, where the appropriateness of the inquiry delivers findings of *relevance*, *significance* and *importance*, the possibility exists for research of *consequence*. In fulfilling these aims, the apithology research ethics of *specificity*, *honesty* and *acceptability* naturally lead to research *receptivity*. The result is that research with these qualities can be seen (within that inquiry paradigm) to be *true*, *trustworthy* and *truthful*, leading to the result that the apithology systems research may potentially be 'trusted' as a basis for future knowledge generation.

Ideally, all of these components should be considered in the formation of an apithology systems research inquiry. To assist the trained researcher in this specific discipline, a practical heuristic form is useful in determining the presences (or absences) in the tests for research veracity.

7. Apithology Evaluation Triptych

The evaluation of apithology research requires an axiology that is reflective of its primary ontology. The form evaluation takes in apithology research praxis is to make such assessments using an apithology triptych. This convention involves the development of a heuristic tool as the conceptual container. The aim of the tool is to enable the reflective processes necessary to evaluate attained levels of proficiency in the formation of generative trichotomies inter-subjectively. This form of praxis provides a means to confirm, by collaborative examination in a community of peers, any claims made to research veracity.

By way of clarification, a triptych is traditionally conceived of as a set of three folded panels depicting three scenes from one narrative, often taken from a religious context. It is usefully didactic or instructive as an illustrative exemplar, and is ostensibly complete on the face of its own three-fold depiction, holding within its form a conjunction of definable boundaries [43]. By analogy, an apithological triptych similarly contains illustrative descriptors of the presence and absence of each element of a generative trichotomy and their resultants as derived by an apithology inquiry [44]. Its explanatory effect is deceptively simple, yet by its internal relations it is also descriptive of multi-spatial configurations in essential formative tensions.

The three-fold combination of tests for ontological appropriateness—*relevance*, *significance* and *importance*—provides possible containers of criteria for the evaluation of multiple forms of apithology systems research. Significantly, in the discipline of apithology, the assessment of conjunctive coherence involves discerning the presence or absence of the contributive dynamics for each component as a trichotomy of dependent relations. Rather than being merely three things that are present occasionally, arguably, or conceptually, the test for the presence of all trichotomous components must be met in actuality. The proposed triptych describes the resultants (as heuristic signifiers) for the different combinations of the three criteria for evaluative sufficiency in an apithology systems inquiry. The resultants represent the possible ambitions that apithology systems research may aim for and will inevitably be evaluated against (Table 2).

Table 2. Apithology systems research: criteria for research consequence.

Validity	Credibility	Reliability	Resultant ¹
+ Relevant	+ Significant	+ Important	Prospective
+ Relevant	+ Significant	– Doubtful	Speculative
+ Relevant	– Arguable	+ Important	Illustrative
– Marginal	+ Significant	+ Important	Substantive
– Marginal	– Arguable	+ Important	Conceivable
– Marginal	+ Significant	– Doubtful	Believable
+ Relevant	– Arguable	– Doubtful	Demonstrable
– Marginal	– Arguable	– Doubtful	Unreflective

¹ Combinations of the presence (indicated by +) or absence (indicated by –) of the three sufficiency criteria generate eight distinctive expressions of apithology research resultants.

By the use of these conceptual examples, it is easy to discern the potential result of the research to be undertaken. An apithology systems inquiry that defines its scope too narrowly, or too broadly so as to be unrepresentative, will not have validity. The effect is its contribution is *marginal*. The apithology system inquiry that makes assertions unsupported by its methodology will not have credibility. The effect is its contribution is *arguable*. The apithology systems inquiry that claims predictability beyond its research maturity cannot be considered reliable. The effect is that its contribution is *doubtful*. The effect of the presence of all of these absences means that the generativist inquiry conducted is unreflective of the inquiry context and, while possibly still correct in its observations, its conclusions will be (within that paradigm) presently unverifiable. This simple test of conceptual stringency illustrates the alternatives and possibilities for generativist research proficiency.

8. Benefits and Implications

In an apithology triptych, the result of the combinations of elements of sufficiency is the generation of eight distinctive alternatives (known to Charles Sanders Peirce as “generative and degenerative” trichotomies). These eight expressions represent a method for discernment of what can potentially result (i.e., a resultant) for each of the combinations of the presence or absence of the essential components (i.e., correlates). The term “correlates” has, in this context, the technical meaning of an essential trichotomous element as derived by an apithology systems inquiry. In essence, the generativist resultant form (i.e., +++) is met only by the conjunctive presence of all correlates. The alternative

configurations, denoted as the combinations of correlates (– – –) to (+ + –), also provide useful comparisons and distinctions for the purpose of evaluation. This depiction recognizes that research outcomes may be well directed (or well intended), yet still remain insufficient as a generativist contribution. From the alternatives depicted, it is easy to discern the essential absence in any resultant form, with a view to making this present in the future (if this is desired). This practical heuristic form makes the design of generativist research scenarios tangible, discernable and attainable in an apithology systems inquiry. The implication from this praxis is to allow for conscious outcome selection in generativist research design, where clear intentions are fulfilled by coherent research outcomes [45]. Rather than evaluating research post-fact critically, the aim is to intentionally design for the generative, generatively.

Importantly, the recognition of the criterion of “veracity” for apithology systems inquiry provides the opportunity to encourage both prospective design and reflective evaluation in research formation. The ancillary benefit of this approach is that the research, and the researcher, will be together enhanced developmentally (and reciprocally) in answering new questions of reflexive self-evaluation. One main difficulty that the apithology researcher previously faced was to discern whether undefined (but essential) criteria were present as a foundation for the proposed research. This difficulty is resolved practically in apithology by the requirement for description using the heuristic device of an apithology triptych. This approach allows the researcher to develop the competence, not only of a self-reflective practice in designing research with efficacy, but the prospective development of the proficiency sought in their own development within the discipline of apithology inquiry.

In summary, to be contributive to the ongoing generation of humanity’s knowing, all three criteria of research efficacy need to be satisfied directly in an apithology systems inquiry. From a generativist perspective, systems research that meets the combined tests of relevance, significance and importance (with coherence) is described in apithology theory as having research *consequence*. It is the undertaking of research of consequence that is the primary advantage that the discipline of apithology provides to its proponents.

9. Conclusions

The extensive array of systems approaches reflects the multitude of systems contexts in which human systems (and their researchers) are embedded. These systems paradigms additionally can be seen as the vital expressions of our collective responsiveness to humanity’s concerns, each generating new questions, and demands for new research. Distinctively, the generativist ontology of apithology systems theory does not require problems, limitations, or dysfunctions to occur before commencing question formulation. This ontological premise of investigating the conditions for enablement in the generativist paradigm is not illusory or speculative. By its adoption in research design, the anticipatory provision of essential presences becomes an ethical research imperative [46]. In the pressing need to respond to problems created by unforeseen absences, a refreshing alternative economy of attentiveness is seen in apithology theory. In answering an apithology research question, the aim is not for problems to be solved, rather the presumption of their necessity, becomes ultimately unnecessary. The implication of this conclusion is that to gain the clear advantages of apithology systems inquiry requires different tests of research sufficiency, especially in matters of consequence to humanity.

The design of generativist systems research benefits significantly from having clear evaluation criteria. This article has explained proposed criteria for the evaluation of generativist systems research as applied in apithology systems inquiry. By this approach, the contribution of systems research to the potential for humanity knowing may potentially be considered more critically and generatively. It is hoped that by the example of this limited study, other systems research disciplines may be similarly inspired to investigate their own criteria for research efficacy.

Acknowledgments: The author wishes to acknowledge the contributions and support of the organizers and participants of the 17th Conversation of the International Federation of Systems Research, and in particular conversations with Gary Metcalf, Mary Edson, Pamela Buckle Henning, Shankar Sankaran, Debora Hammond,

Louis Klein, John Kineman, Gary Smith, David Rousseau and Jennifer Wilby on questions of systems research philosophy and praxis that assisted in forming this research.

Conflicts of Interest: The author declares no conflict of interest.

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