Chapter 6
Systems Research Reporting

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Abstract The competent design, planning, undertaking, and analysis of systems research deserves to be reported well to reflect its systemic strengths. The very best systems research will evidence a systemic approach in its structure, content, and overall contribution to the field. To enable a systemic approach to systems research reporting, a researcher must frame and select from a number of considerations specific to the systems field. This chapter provides clear guidance for systems researchers in a systematic approach to writing up and reporting research in the systems sciences. The distinctive roles, forms, levels, phases, and premises of systems research are outlined for consideration. A systematic approach to reporting highlights the elements of structure, boundary, relations, timing, and completeness that assist favorable evaluations. The researcher is also directed to the critical choices they must make between systems definitions, paradigms, voicings, and perspectives. The chapter concludes with a consideration of common errors of omission and the unique ethical tensions experienced when undertaking contemporary systems research. This content will benefit early career systems researchers, research article reviewers, examiners of dissertations, and experienced systems practitioners in making their own contributions to the wider systems discipline.

Keywords Systems theory • Research reporting • Systems research • Boundary definition • Ontological frame • Systemic thinking • Systems ethics

Approaches to Reporting Systems Research

The previous chapters of this book (Chapters 1, 2, 3, 4 and 5) outline many necessary considerations for the researcher when conducting systems research. These considerations include systems definition, framework selection, problem structuring, research design, scenario modeling and systemic intervention. This chapter

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M.C. Edson et al. (eds.), *A Guide to Systems Research*, Translational Systems Sciences 10, DOI 10.1007/978-981-10-0263-2_6

considers the unique decisions taken by systems researchers in communicating and reporting the results of their systems research. The writing up of your research will reflect your competency in systems research (see Chapter 7). The thoughtful reporting of your systems research enables the favorable evaluation of that research (see Chapter 8). In this way, the writing up and reporting of systems research can provide benefits for the researcher and to the systems research discipline equally.

The role of this chapter is to guide you in your writing up and reporting of systems research. It highlights the critical choices you will need to make and how these inform the reporting process by proposing a systemic approach to communicating research. The focus is on what is uniquely different about research reporting in the systems disciplines. This will help you communicate your research to systems literate and non-systems expert reviewers with ease and clarity. This chapter also adopts a systems approach to this topic to illustrate the principles of systemic inquiry.

This chapter is structured using five main themes:

- Features unique to systems research reporting;
- Systemic approaches to composition and balance;
- Choices in reporting and writing-up systems research;
- Common errors of omissions in systems research reporting; and
- Ethical considerations in undertaking systems research.

The chapter will benefit early career systems researchers and doctoral candidates in planning their research. It will assist researchers who find they have a systems component when doing research in other disciplines. The discussion will provide article reviewers and examiners of dissertations with confirmation of the critical elements to look for. The chapter may also highlight new considerations for the experienced systems practitioner and for the systems discipline itself. Our discussion commences with an overview of some important questions and consideration of the difficulty of attaining a balance when meeting competing demands.

Questions in Systems Research Reporting

The systems sciences can be seen as representing an identifiable and established field of research (von Bertalanffy 1968, 1972; Hammond, 2002). Systems research may also be conducted within the conventions of other formal scientific and research disciplines (Klir, 2013). Excellent guides already exist outlining the forms and conventions for writing up research in those disciplines (see Chapter 5). If you adopt a systems approach to your research certain features not usually considered relevant will become important and significant. This chapter focuses only on the features specific to *systems* research reporting. It concerns the considerations and inclusions additional to those required by other disciplines. It will help you isolate the questions unique to systems research reporting.

Some of the critical questions covered in this chapter include:

- What is the role of systems research reporting?
- How is systems research distinguishable from other research?
- How can I plan to write up my systems research adequately?
- What are the key reporting considerations and how should I approach them?
- Why are the choices of voicings or voice, tense, stance, and tone so important?
- What will good systems research ideally show to assist favorable evaluation?
- What else does a researcher need to consider when making reporting choices?

To answer these questions, this chapter consciously adopts a systemic analysis. By doing so the intention is to enhance the critical reflexivity of systems researchers when reporting on their research. Topics covered in this chapter include:

- The critical questions asked in systems research reporting;
- The choices of balancing competing tensions in writing up;
- The distinctive roles for systematic, systems, and systemic research;
- The three forms of systems research as context, content, and concept;
- The abstraction of systems analysis as levels of critical inquiry;
- The phases of scientific research (as a system) and its validity claims;
- The principle of concordance in designing systems research efficacy;
- The consideration of the systemic elements in research composition;
- The choice in meanings, paradigms, and complexity in systems research;
- The benefits of finding consistency in voice, tense, stance, and tone;
- The common errors of omission seen in competent research reporting;
- The ethical considerations unique to reporting in the systems sciences;
- The role of systems research in enabling humanity contributive knowing.

To allow you to navigate this vast territory there are clear signposts to help you. Each section of the commentary is supplemented by suggestions for best practice. Rather than being prescriptive, these suggestions prompt you to check your thinking and engage in reflective practices. This is done with the view to empowering you as a researcher to make your own research reporting decisions. The hope is to enable your awareness of the flexibility of choices possible (and the implications of your choosing). This provides you with more than advice, being the pathway to self-guidance (Richmond, 1993). In walking that pathway you will naturally see how the reporting stage helps link the research process from conception, formation, observation, moving through to publication.

Balance in Systems Research Reporting

There is no simple guide to the balancing of composition in research generally, or systems research specifically. The perfect mix between describing theory, process, data, analysis, and findings depends on the novel content and specific context (Creswell, 2012). Hints from standard reporting and style guides suggest being

"convincing," "clear," and "brief" (Merriam, 2009), while also balancing "description and interpretation" and "commentary and illustration" (Ritchie, Lewis, Nicholls, & Ormston, 2013). The reporting requirements for qualitative, quantitative, and mixed methods research are specific, prescriptive, and possibly contradictory (Midgley, 2000).

In *systems reporting* there will be additional information to include, such as system definitions, framework explanations, scenarios models, novel interventions, and speculations on dynamics. In a review of many articles using a broad range of systems methodologies the reporting of systems research can appear to be idiosyncratic, with each case relying on its own paradigms of practice. Your main aim in doing systems research reporting well is to ensure that the systems elements of your research are easily identifiable for your intended audience. Like all systems work, this involves finding a systemic format that balances all the tensions, between different components, within one comprehensive structure. To do this well you will need to resolve some clear contradictions, especially those of meeting the needs of different systems audiences (i.e., systems-literate and non-systemic thinkers). Ideally, a systems approach to systems reporting enables all the parts, and the whole, to work elegantly together in the intended contexts.

Some crucial tensions and choices for systems reporting include:

- Speaking to abstract forms and intangible dynamics, concretely;
- Using frameworks to guide an inquiry, recognizing what they omit necessarily;
- Describing the full systems context, without losing the points of focus;
- Including all components of relevance, while noting elements of significance;
- Having rigor in the main methodology, within a flexible mode of inquiry;
- Treating the system as being complete, while recognizing a wider totality; and
- Meeting the level of complexity of the system, but describing this simply.

The following sections give a guide on how to balance these tensions and approach these reporting questions. This will enhance the communication of your (already proficient) research distinctively.

Features Unique to Systems Research

> Sometimes half a dozen figures will reveal, as with a lightening flash, the importance of a subject which ten thousand labored words, with the same purpose in view, had left at last but dim and uncertain.
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> —Mark Twain, *The wit and wisdom of Mark Twain*

If we take a moment to reflect on the question, "What is unique about systems research?" it is not surprising that doing system research generates questions about the forms and functions of research itself. There are three systemic features that become immediately apparent in a systems context. These relate directly to (a) the appropriateness of the research form, (b) the structure of the parts, and (c) the efficacy of the whole. These three considerations are central to a systems approach

generally. The systemic elements of the research itself can be analyzed similarly. They highlight the *concept*, *composition*, and *concordance* of the research process being reported. Together these constitute a useful systems research aesthetic.

An aesthetic test for reporting on systems research is to confirm the researcher has considered these features by identifying: the systemic boundary (of assumptions), the system of relations (in the composition), and the totality of effect (from their combinations). An elegant piece of systems research will potentially have each of these elements in harmony. For the systems thinker, elegant research has a balance in these elements intuitively. The skillful systems researcher may even embody *systemic beauty* in their research design consciously. When conscious design is explicitly followed throughout the conduct of the study, this balance serves as a meaningful locus for coherence. The resulting reporting will ideally synthesize analysis and integrate findings to form an erudite and resonant discussion.

Research that is confused as to its boundary of inquiry, that is missing critical and obvious components in the report itself, or that does not function logically as a totality, cannot be looked upon favorably. Part of doing good systems research is knowing what a good systems researcher looks for. A special opportunity presents itself in the reporting phase of the research. This moment allows you to view your research by standing outside of the system of research itself, to examine its composition, and to check how it functioned as a research system. The critical reflexivity, to do this inquiry adequately, is the main focus of this section. An appreciation of the difference between systems roles, forms, levels, phases, and premises will help you in this reflective task.

Roles of Systems in Research

The question asked is: What are the reporting formalities that enable systems research efficacy? Considering all of the critical choices described in the prior chapters (i.e., systems definition, framework selection, problem definition, research design, modeling options, and forms of intervention) arguably the role of systems reporting is actually the most important in conducting good systems research. The reason for this statement is that until a systems inquiry is reported, in ways that can be recognized and validated by its community of peers, it is not research. It is the formalities of the reporting conventions in research disciplines that allow personal inquiry and experimental actions to be verified as contributions to the knowledge commons. By following these conventions you allow your research to be recognized fully.

Otherwise sound systems work that reports its findings only selectively, without rigor in its composition, or the possibility for evaluation, may not be considered to constitute valid research. Arguably, such examples are at best a recording of personal reflections and opinions, and at worst an advertisement for unsupported viewpoints. To constitute research there are requirements for writing up and reporting. There are also formal (and informal) requirements that delineate systems research from other forms of research reporting.

Foundationally, the basics for writing up academic research in each of the major disciplines will apply to systems research when conducted within those disciplines. The inclusion of systems concepts, within research primarily conducted within an established discipline, will not exempt the researcher from adherence to that primary discipline's baseline standards of research reporting. The many research handbooks provide clear guidance on the requirements of such research fields, with some examples being:

- Handbook of Innovation in Social Research Methods (Williams & Vogt, 2011)
- Handbook of Qualitative Research (Denzin & Lincholn, 2011)
- Handbook of Mixed Methods in Social and Behavioral Research (Tashakkori & Teddlie, 2010)
- Handbook of Organizational Research Methods (Buchanan & Bryman, 2009)
- Handbook of Research Synthesis and Meta-Analysis (Cooper, Hedges, & Valentine, 2009)
- Handbook of Systems Engineering and Management (Sage & Rouse, 2009)
- Handbook of Quantitative Methods: Health Science (Peat, Mellis, & Williams, 2002)
- Handbook of Research Design and Social Measurement (Miller & Salkind, 2002)
- Handbook of Action Research: Participative Inquiry and Practice (Reason & Bradbury, 2001)
- Handbook of Applied Social Research Methods (Bickman & Rog, 1998)

Rather than précis or paraphrase this existing guidance, we can instead examine the specifics of reporting for systems research. The proposition is that the inclusion of systems concepts in any research provides *additional* demands on the standards of reporting, the assumptions that may be made, the format for research reports, and the conclusions that may be validly drawn. In support of this suggestion, it is useful to distinguish how the use of systems ideas provides three distinct and important roles in research (generally):

- *Systematic processes*: the contribution of the systems sciences in informing and formalizing systematic approaches to reliable and repeatable research procedures.
- *Systems descriptions*: the use of concepts, formal terms, and descriptive language that researchers may use to define and describe the systems they are researching.
- *Systemic understanding*: the role of systems thinking in linking causes and effects and connecting contingent factors when examining a specific phenomenon in an identifiable situation or context.

These different systems roles change the reporting of research outcomes. Systematic processes in non-systems disciplines provide tests of rigor. Systems descriptions will follow frameworks and their presumptions to demonstrate the efficacy of those applications. Systemic understanding allow for novel inquiry by mastery of systems thinking in lineages of philosophy. The blurring of these roles might mean the research is seen to be (in each case) as lacking in rigor, efficacy, or mastery. Being clear as to the chosen role systems ideas take in your research will allow you to blend these roles appropriately.

Suggestion

- Consider the role of "systems" in your proposed research and how that role will be ultimately best fulfilled. Other than calling it a "system," what is there to evidence systematic processes, systems frameworks, or systemic concepts? If the idea of a system is used only informally, how will your research be viewed when considered by a systems-literate community?

Forms of Systems Research Emphasis

Given the different roles of systems research in establishing *systematic* process, *systems* descriptions, and *systemic* understandings, it is important to characterize three forms that systems research may take in fulfilling those roles. Each form has a very different emphasis. This alters the primacy of system concepts in the research performed. For convenience, these three primary forms of systems research are:

- S*ystem as context*—the skillful research done within an existing and identified system (e.g., health systems, ecosystems, accounting systems, software systems, financial reporting systems) adopting usual research processes (e.g., empirical analysis, social research methods, error identification by audit, etc.)
- *System as content*—research having as its focus the understanding of a system, its components, and dynamics (e.g., health care procedures, ecosystem modeling, evaluating software design, planning for urban services), probably using systems theory methodologies and frameworks developed in the systems research paradigm (e.g., general systems theory, viable systems modeling, soft systems methodology, system dynamics analysis).
- *System as concept*—the research done into the efficacy and proficiency of systems theory itself, specifically looking at the assumptions, applications and extensions of systems theory as a research discipline and the efficacy of its practice paradigms across multiple disciplines (e.g., general systems theory, complex adaptive systems theory, complexity theory, hierarchy theory, panarchy theory, systems ontology).

The distinctions between these three forms of systems inquiry require the researcher to allocate significance to the systems research elements in ways appropriate to the research conducted (i.e., system as *context*, system as *content*, system

as *concept*). While these distinctions may be arbitrary, with good research containing a mix of one, two, or all three forms, there are different expectations on the critical analysis of the system elements required for each of the three forms. The implication in writing up the research is to ensure the rigor adopted matches the chosen systems emphasis.

For example, research within a system needs to recognize the system's distinctive existence by identifying it as a definable system. Research using systems theory needs to reference systems thinking formalities, comprehensively and accurately. Research about systems research requires a higher order of abstract logic, to consider the premises of systems research itself, as a discipline of inquiry. The use of ill-defined system reifications, poor framework applications, or uninformed systems speculations will create noticeable omissions in otherwise good research applications. While the choice of best form will be the one most appropriate to the research context, clarity about the form of your intended contribution will mean that significant amounts of underpinning theory may be omitted knowingly. The researcher's main obligation is to be clear about how *systems* are used in their research and to allocate the commensurate degree of systems analysis.

Suggestion

- Being clear about the form of systems research being undertaken means the expectations of reviewers, as to which questions are examined (or left unexamined), can be applied more reasonably.

Levels of Systems Research Inquiry

In addition to the *roles* and *forms* of systems research, it is worth considering the *levels* of research reflexivity appropriate to your inquiry. Cyberneticist and systems theorist, Gregory Bateson (1972) described iterations in the logical categories of types of learning (i.e., Learning 0—Learning IV). Those distinctions can be usefully applied to systems research and its analysis. For this specific purpose:

- *Learning I* operates when the active recognition of good methods enables new information to be gathered effectively without error repetition.
- *Learning II* occurs when the process of gaining new information is itself questioned and then refined or revised by forming alternative methods.
- *Learning III* occurs when the paradigms and assumptions informing the choices of the design of methods are themselves reformulated.

Later characterized as "double-loop" and "triple-loop" learning (Tosey, Visser, & Saunders, 2011), the practice of reflection on each of these levels of abstract logics enable the "system of the system" for research to be actively researched. The level

of learning aimed for and actually adopted changes the expectations of the research considerably (and the validity claims that can be made correspondingly).

For example, a researcher may use an existing test instrument to find out about changes in learning occurring in an education system (Level I). In examining that data, new questions may arise as to whether a learner's age or developmental stage provides the better systemic premise for measurement (Level II). From this analysis, questions may arise as to whether the premise of how learning occurs systemically may then also require re-examination (Level III). This may lead to a systemic reconceptualization of the idea of learning, the structure of its key components, and the methods for its assessment. While all these forms of study are valid, each will direct the researcher to different categories of systems content.

Even when the format of the reporting may be firmly established by the paradigm of practice adopted at the commencement of the research, the significance of the final systems emphasis of the research can be initially unclear. When formulating the research question the level of systems analysis is often not known. The researcher may find, in using systems methods, that the assumed and fixed elements of existing systems become openly questioned. It may be we are looking at the wrong system, or the right system is being looked at wrongly. The point is that this natural shift of the level of systemic focus during the research dramatically affects the research and its resulting reporting.

Suggestion

- Consider the permitted assumptions for both the system being researched and the system of permitted research. Check if the form of reporting requires uncritical acceptance or allows for challenges to assumptions. If the level of inquiry shifts during the research, the research emphasis (and the content considered adequate) may also need to change. This unexpected change in emphasis is a natural trajectory of good systems research, which can be actively and consciously embraced

Phases of Systems Research Method

In addition to decisions about clarifying the specific roles, forms, and levels of your systems research in your research reporting, there is a further overall consideration. This is the recognition that research is itself a system in iteration. Traditionally, research methods have been divided into three primary domains: *deduction*, *induction,* and *abduction* (Magnani, 2001). Karl Popper (1959, 1972) proposed that these three distinctive phases of research work operate as an entire system, with a grounded hypothesis (i.e., abduction), becoming proven or disproven (i.e., deduction), and its extensions then tested (i.e., induction), for pragmatic and beneficial outcomes. Deduction extends existing assumptions. Induction

expands on existing applications. Abduction initiates novel innovations (Varey, 2012). Each has their appropriate uses as well as specific strengths and limitations and (see Chapters 1 and 3).

These three different phases of research also have different reporting requirements, which relating to the limit of the knowledge-based claims that the phase of the research makes possible. The respective validity claims can be summarized as:

- *Deductive*: Due to specificity of the context and constraints, claims can be made about the conclusiveness of findings for that situation (i.e., because X was considered assuming Y, we can conclude Z).
- *Inductive*: In reporting on the basis for comparison, claims can be made about the validity of extensions and scope of applications (i.e., because X is like Y, we can possibly say Z about Y).
- *Abductive*: By analysis of the general features of the broad case, claims can be made about possible principles and their relations as hypothesis formation (i.e., because of Z occurring in case X, we can assume Y).

This distinction is often overlooked or historically assumed for other disciplines. For example, deductive empirical studies may begin with a hypothesis, inductive social studies often commence using a comparative narrative, and systems engineering and computational logics may begin with only a few abstract parameters. The development of systemic understandings can be less prescriptive in the wider fields of systems research. The formation and modeling of a system can involve descriptive exploration, abductive investigation, and active co-participation to find the best possible alternative from many combinations. The forming of a novel systems conception by abductive methods will provide a premise for later critical evaluation, practical testing in known situations, and the possibility for future extensions to new applications. The role of formal abductive logic is central to good systems research generation (Aliseda, 2006; Rozeboom, 1997). The intended *phase* of system research deserves specific noting and requires corresponding rigor in its processes of reporting.

Suggestion

- Consider the phase of your research. If claims of a deductive proof are made, ensure the hypothesis uses assumptions that are reliable and are established for that system. If an inductive extension is claimed to be valid, confirm that the comparison is of systems that have equivalence in structure and/or function. If the research is abductive and novel, ensure that the tests for valid abductive logics have been explained and are reported adequately.

Premise in Systems Research Design

In advanced applications of systems research, while the consideration of role, form, level and phase is relevant—there is also a need for systemic functionality in the formation and execution of the research method itself. It is this particular feature of good systems research that allows for the discovery of the undiscovered, the illumination of the hidden, and the validation of the previously unimagined. Mature systems researchers may use a systemic analysis of their research premise to formulate new paradigms for practice in scientific understanding (Kuhn, 1974).

In following the history of the development of systems theory (see Chapter 1), we can recognize the distinctiveness of systems philosophy, its premise of epistemology, the unique use of methodologies, and the nuanced qualities of inquiry that combine to represent good systems research. In mature research fields the assumptions of how good research is done has been long established. The alignment of the understanding of reality, the ways of knowing, the methods for gaining information, and the manner in which this is communicated are clear, precise, consistent, and static.

For the systems researcher, the many forms of systems (e.g., natural, social, ecological, physiological, cosmological, theosophical, virtual, and their conjunctions) mean the premise of validity in research forms is not so predetermined. However, the way in which research choices form and shape a systematic research approach can be examined systemically. This "systems approach to systems research" is described as the testing of philosophical concordance (Varey, 2013). The proposition is that good systems research design should ostensibly contain an alignment between the philosophically critical elements adopted for good researching.

For example, in the field of social systems research, Creswell (2012), extending on the work by Guba and Lincoln (1994), proposed five categories that social researchers may consider in formulating their research design. These five dimensions are the: (a) ontological; (b) epistemological; (c) methodological; (d) axiological; and (e) rhetorical assumptions of the research. The suggestion is that good social research involves an inquiry into "choice sets," not simply to establish research completeness, but also to formulate research proposals that have efficacy across these five dimensions.

In examining ecological and hierarchical systems, Ahl and Allen (1996) have proposed a similar requirement for alignment, focusing on the tensions between five components. They identified five "junctures" in an iterative process "at which an observer's decisions are crucial to structuring an observation" (Ahl & Allen, 1996, p. 35). Those sets of choice are framed as: (a) question formation, (b) entity definition, (c) measurement selection, (d) phenomena recognition, and (e) modeling predictions (Ahl & Allen, 1996). This approach highlights the reciprocity between the observer and the observed in a constructivist approach to the design of systems research. A similar level of definition may be appropriate for a constructed approach to novel and dynamic systems, in systems engineering, systems software design, or for the formulation of virtual systems.

In writing-up systems research, the report of the research will ideally (even if briefly) situate the choices of: (a) system philosophy, (b) epistemological framework, (c) systems research methodology, (d) paradigm axiology, and (e) form of system depiction, as components within a totality. The researcher should justify each selection with reference to the other elements of composition. In this way, the research as a whole may be considered to include "informed, relevant, appropriate, significant, and representative" elements (Varey, 2013).

This simple test enables the evaluators of the research to confirm the research design has the elegance of philosophical concordance. Omissions in the alignment of any one of five forms may constitute a critical research design error. This will be clearly apparent. The systems reviewer will necessarily inquire to confirm whether the research:

- Assumes a certain systems philosophy, without any form of prior inquiry;
- Relies on a framework epistemology, in conflict with contextual reality;
- Adopts a default methodology, not useful for the intended discovery;
- Overlooks inputs of axiology, to omit or negate factors of significance; and,
- Represents a schema simplistically, hiding relevant levels of complexity.

Of course, research that is concordant in its approach may still be completed ineffectively with nothing to show for the efforts, and research with these critical design questions omitted may be done exceptionally well, also yielding remarkable results. More frequently, without any critical analysis of the assumptions that inform the research premise, the reviewer or examiner is left perplexed at the certainty of the conclusions reached by the researcher and will be unable to assess the validity of the system of research adopted (Ulrich, 1983).

While peers and colleague researchers may have a preference for a different general systems philosophy, a personally resonant epistemology, familiar research methodology, standard tests of inclusivity, or an iconic form of system representation, to be considered *research* in the systems discipline, a valid analysis requires more than assertions of personal preference. The ability of the researcher to assemble the parameters of their research with efficacy also says a great deal about their systems research ability.

Suggestion

- It is a courtesy to reviewers holding a different preference in systems methods to explain the choices of components adopted in your research approach, how they relate in the research context, and what (by definition) they must include, omit, or reveal to enable the critique of the premise adopted for the systems research.

Systemic Approach to Composition

> The time to begin writing an article is when you have finished it to your satisfaction. By that time you begin to clearly and logically perceive what it is that you really want to say.
>
> – Mark Twain, *The wit and wisdom of Mark Twain*

The diverse application of systems thinking in many research fields means there is a plurality of forms for systems reporting. Where a research paradigm (whether quantitative, qualitative, mixed method, or multi-method) requires set sequences it can be seen as having a *systematic* approach. The use of methodical procedures and handbook checklists, while systematic, may not be *systemic* (Ison, 2008). The distinction made here is that applying a rigorous process, to a complex situation, may not involve the use of systems thinking processes. Adopting the idea that the research concerns "a system" is not synonymous with using a "systems approach" as the research method (Checkland, 1999). Arguably, to be good systems research, systems ideas, principles, and concepts should be used for organizing the actual research itself.

The proposal of this section is that systems research must not only follow a system, but the components of the research, the sequence of research steps, and the resulting compilation of the research should also reflect a systems approach. While this is not strictly necessary for research making use of systems concepts unsystematically, it is possible that *good* systems research should reflect a systems philosophy. The following sub-sections will highlight the basic systems concepts that make systems reporting a *systemic* (as opposed to simply a systematic) activity.

Structure: Limits of System Framework

The structure of a system is discernable by the distinction of its parts. For systems reporting the components of the research report must be clearly identifiable. The standard quantitative reporting components of *research question, literature review, method design, experiment results,* and *research conclusions* provide a clear list of components for students. However, while making clear distinctions, this listing itself does not explain the *system* of the research.

When doing research into systems, whether naturalistic or human designed, the researcher will usually find a linear and idealistic process might not match with the systemic realities. The effect is that the process of method design may be iterative, with a need for recurrent sampling, reflections on action research questions, time to observe the effect of change from interventions, and the modeling of alternatives leading to further novel trial experiments.

The proposition is that some of the best systems research is by definition "systemic" and so cannot be pre-designed to be systematically consistent (Ison, 2008). At some point in examining dynamic, emergent, evolving systems, linear reporting processes can no longer serve the paradigm of their inquiry. For this reason, the

system of the research adopted may need to be explained more as a sequence of causations, which should be transparently outlined by a clear description of the stages and their components as they were performed. There is often a systemic logic to the systematic discovery of systems features (Simon, 1977). The systemic approach is rational and defensible, even if not necessarily seen as being linear, prescriptive or predictable (Checkland, 1999).

Boundary: Inclusion of System Participants

It is sometimes claimed that systems research approaches are (by definition) more holistic and inclusive (Hall & Fagen, 1956; Jackson, 2003). The systems approach suggests that by simply looking at objects in a context, its research methods are more universal by holding a potentially wider perspective (Meadows & Wright, 2008). However, the mature systems researcher knows acutely that studying a system also involves making informed (yet arbitrary) judgments of limitation (Ison, 2008).

A system is often defined precisely and clearly for research purposes. The usefulness of the research is restricted by its implicit limitations, which are a function of what it explicitly includes (and excludes) in its considerations. The ethical systems researcher will also recognize the effects that boundary judgments play in inclusions (and marginalizations; Midgley, Munlo, & Brown, 1998). To make any valid statements or conclusions, good systems research should be explicit about its processes for boundary definition, delineation, and extension (Midgley, 2000). Even if mostly an abstract theoretical hypothesis, the research strength of a system analysis lies in the descriptions of the boundary of its intended valid use, and the obvious resulting exceptions to which it has no application.

Relations: Sequence of Research Actions

The obvious addition to considerations of structure in a system of research is the need to make explicit the dependent links between the research components within that structure. Generally, systems involve patterns of interconnections (Bateson, 1972; von Bertalanffy, 1968). However, it is the strength and pattern of relations between those interconnections that give a complex system (and its sub-systems) the characteristics of an identifiable system of significance (Maturana, 1981; Simon, 1962).

Systems reporting requires more than completion of a formulaic list. As the inquiry generates emergent information, the system of reporting may also require reformulation. The understanding of how choices of selection at one stage of the research inform and affect outcomes and opportunities at other stages of the research shows a systemic understanding. As an example, one purpose of this book is to assist the systems researcher in making connections by understanding the relations

between critical choices in systems research design through separate, although intricately related, topics. By linking the elements of relevance, a stronger overall whole can be constructed. In this way, sound systems research can adopt fixed (and emergent) rules within flexible (and responsive) governing strategies (Koestler, 1969).

Timing: Release of Systems Conclusions

An additional consideration in systems reporting is the recognition that the systems being reported on will be operating in timeframes and cycles set by the system (Holling, 2001). While the mantra of "publish or perish" may create an environmental urgency, the system being investigated may not have process cycles that fit exactly or neatly within funding, project acquittal, or publication deadlines.

If systems research describes a particular system cycle, the researcher must be circumspect about reporting on systemic outcomes, definitive observations, or resulting impacts on any shorter timeframe (Ahl & Allen, 1996). This tension of making findings available in the "immediate now" has an impact on the validity of statements of the effect for "longer-now" life-cycles. Examples might include reporting on systems of ecological impact, modeling of probabilities of climate studies, longitudinal studies of health risks, or the lifetime effects of chronic stress and psychological change. The timing and content of systems research reports might actually depend on the system, not the career of the researcher.

Completeness: Adequacy for Systems Evaluation

Often the evaluation for systems research reporting follows prescribed criteria or will use a scoring rubric (C. Perry, 1998). A doctoral dissertation examiner will have specific criteria to report on. An academic journal will have a template for submission and criteria for the reviewer to use to confirm acceptance. Good research with distinctive qualitative merit, that fails to meet specific criteria, can fail to be communicated due to its incompleteness. Sometimes, ostensibly good research will be denied publication simply because of overlooked procedural criteria. For this reason, never forget to obtain the evaluation rubric prior to designing, completing, and submitting your (otherwise complete) research report.

For example, a respected systems research journal's editorial policy will require the reviewer to consider:

- Does the manuscript contain new and significant information?
- Is this new information sufficient to justify publication?
- Is the title, abstract, summary, tables, and article length sufficient?
- Is adequate reference made to other work in the field?
- Can any of the material be deleted without detriment?
- Does the work have originality, accuracy, and completeness?

Similarly, a doctoral dissertation committee may consider criteria like:

- Originality and scholarship;
- Contribution to knowledge;
- Independence of analysis;
- Criticality of thought;
- Situated relevance to wider discipline;
- Clarity and cogency (of argument, tables, and diagrams);
- Strengths and limitations (of scope and research design);
- Coherence of linkages (between method, analysis, and conclusions).

The significance of such criteria is that, while the research must be conducted impartially and independently, the reporting of research is situated within the context of the formal systems that enable new additions to human knowing. Those systems begin with the processes for evaluation, review, and publication and extend to how research enables and extends humanity's own understanding of the processes of its knowing. When we reflect on the primary contribution of valid research, the research itself is only one component. The wider system of researching also benefits each time a researcher adopts a sound system for their research (Kuhn, 1983). The participation in good research processes knowingly may itself be a benefit equal (or greater) to the actual research outcomes delivered. In this way, the research, the researcher, and research generally may each develop concurrently.

Suggestion

- Consider drawing of a schematic of the system diagram of your actual research design as a checklist for your own understanding of the five elements of "systemic" systems research (i.e., structure, boundary, relations, timing, completeness). If the elements do not come together as a logical proposition, reflect on the systemic weaknesses and the reasons for their presence. Seek guidance from other experienced researchers as to possible inclusions, modifications, or alternatives.

Choices in Reporting and Writing Up

> A successful book is not made of what is in it, but what is left out of it.
>
> – Mark Twain, *The wit and wisdom of Mark Twain*

From the suggestion to think about describing a systems research inquiry systemically comes the question of "Which elements, from the whole of the research, are to be selected for their significance?" The researcher will recognize

that these choices affect the way in which the research is received. In this section, we will consider choices in meaning, paradigms, tone, and complexity. These are questions of emphasis common to the writing up of all research. The following discussion reveals the distinctive choices systems researchers need to make and why these are specific to systems research.

Choice of Meaning: Systems Concepts and Conventions

A difficulty facing systems researchers is how to use systems terms consistently. This concern also applies to those researchers introducing systems concepts into other disciplines. The use of unspecified and ill-defined *systems-like language* is a constant source of ambiguity in the communication of systems research findings. In communicating across paradigms, and in multi-disciplinary contexts, often the different reading audiences will maintain a very different systems lexicon.

Even within the systems discipline, different schools, and paradigms use similarly defined concepts as "terms of art." These terms, when used accurately, will have context specific and historical meanings (e.g., system dynamics, systems thinking, systems models, systemic interventions; Ramage & Shipp, 2009). The disciplines that inherently involve elements of systemic design (e.g., architecture, organizational management, software engineering, urban planning) also adopt terms resembling systems concepts for ideas involving distinctly different meanings (e.g., structure, function, form, open, closed, order, flow, etc.). Familiar systems terms may have a common usage, a formal systems definition, and a discipline-specific technical meaning (see Table 6.1). In reporting your systems research you must distinguish between these terms consistently and expertly.

Table 6.1 Common systems research terminology (and homonyms)

Defined term	Common meaning	Systems meaning	Technical meaning
Holistic	An entire thing (e.g., all parts together)	A distinct philosophy (e.g., holism vs. atomism)	The field of healthcare (e.g., holistic medicine)
Feedback	The giving of advice (e.g., positive customer appraisal)	A cybernetic information loop (e.g., positive feedback loop)	Any compounding noise error (e.g., data filtering)
Complexity	A difficult problem (e.g., business management)	The field which examines hierarchical integration (e.g., complexity theory),	The engineering of complexes (e.g., computational engineering)
Emergence	The appearance of newness (e.g., entering industry player)	A pattern in dynamic complexity (e.g., the emergent property)	The event of biological evolution (e.g., emergence of life)

(continued)

Table 6.1 (continued)

Defined term	Common meaning	Systems meaning	Technical meaning
Sub-system	A smaller part (e.g., a separate sequence in a manual)	A component in systems hierarchy (e.g., sublimated orders of complexity),	A specific component in an engineering schematic (e.g., an electronic sub-routine)
Network	A related group of people (e.g., a business network),	A set of systemic relations (e.g., networked food-chains)	Some formalized structural linkages (e.g., electricity transmission grid)
Structure	A construction project (e.g., an incomplete building)	The composition of a mapped system (e.g., relations of system parts)	An aesthetic totality (e.g., the architectural form)
Model	A small-scale replica (e.g., a model of the prototype)	The replication of systemic patterns (e.g., causal loop run-times)	The experimental manipulation of parameters (e.g., testing aerodynamics)
Dynamics	The tensions between people (e.g., sources of conflict)	The variables in a system (e.g., parameters for alteration)	The range of performance (e.g., the metrics of engine outputs)
Order	The sequence of events (e.g., the ordering of steps)	The arrangement of components (e.g., concatenation of relations)	The aesthetics of complexity (e.g., the transition from order to chaos)

These few examples highlight the precision of description required in systems reporting. When writing up systems research it is worthwhile to be aware that a term familiar to you (and your peers) will have a very different meaning and conceptual foundation when read outside of your discipline (or peer group). The use of an ambiguous term for a precise systems concept in formal system theory (e.g., hierarchy, resilience, tolerance, boundary) will be clearly apparent to a systems-literate reader.

Suggestion

- Use a glossary of systems terms during your write-up to confirm your accurate use of each systems concept, and provide a text-specific glossary if these terms will differ in use from their formal (or common) meanings.

Choice of Paradigms: Schools, Methods, and Models

It is useful to a novice reader of systems research if they can quickly locate your unique research topic within the wider landscape of academic research. When engaging in multidisciplinary research, or multi-method research processes, such

delineations may seem artificial. However, to be read and received well, the community of discourse for whom the research is most recognizable and relevant, should be named. This step of naming the primary paradigm guides not only adherence to existing standards of discourse, it also helps with locating which journals, publication formats, and reviewers will most value the research and respect its integrity.

The classification of academic disciplines is itself a complex system of discrete, yet interconnected, boundary delineations (Del Favero, 2003). The identification of a commonly accepted list of departments, faculties, disciplines and fields involves consideration of paradigm maturity, pragmatic application, and system focus (Biglan, 1973). To assist you in locating your own research, consider the following delineations as a generic guide (see Table 6.2).

Table 6.2 Delineations of research fields, paradigms, and schools

Category	Common definition
Field	An area of study in science or research
Discipline	A branch of formal learning or inquiry
Paradigm	A set of exemplar practices or processes
School	A group of like-minded people in study
Methodology	A scientific method of applied research
Method	A systematic procedure in formal use
Modality	A particular approach, technique, or process
Locality	A geographic region or business association
Sponsor	A person or group supporting a broadcast
Profession	A group of people in a calling or vocation

The acceptance of a researcher's chosen form of research design will benefit greatly from the matching of the research question and the chosen approach to the paradigm of its formal reporting. Knowing where to situate your own unique approach to a systems research question will ensure there is a receptive location for your research contribution. The suggestion to those choosing to navigate by intuitive "way-finding" in the oceanic currents of new knowledge is that is worthwhile to also locate the islands and safe-havens in the embodied paradigms of our knowings (Maturana & Varela, 1987).

Suggestion

- The simple reflective practice of inserting a one-line description of how (or where) your research is located within each of the levels of a field will provide you with your research identity and focus. In choosing to locate within a paradigm, research group, formalized modality or defined locality one can still innovate, while noting the limitations and providing new developments, from within a sound theoretical foundation.

Choice of Tone: Voice, Tense, and Stance

The concepts of voice, tense, and stance are often confusing for early-career researchers. For clarity, these can be defined as:

- *Voice:* the syntax of a sentence emphasizing either the subject or object of the topic discussed (e.g., active, passive).
- *Tense:* the time of occurrence in terms of the description of what is happening, did happen, or is intended to happen (e.g., past, present, future).
- *Stance*: the location of the researcher in relation to the system indicated by their reporting perspective (e.g., participant, commentator, observer).

In generic writing education a trend has been to promote use of the "active voice" where possible. The active voice is seen to be concise, clear, direct, bold, vigorous and convincing (Strunk, 1918). This is an important skill to learn for early writers. It helps to develop their opinions and gain a level of confidence in self-expression. In systems reporting the blind use of active voice has the distinct problem of confusing objective observation with narrative opinion. In stating clearly "how things are" it is difficult to evaluate how this may be different to unsupported statements of "how things appear to me." In reporting on systems research, the active voice can be actively misleading.

To be intimate enough to astutely describe (and notice changes in) a system, requires the systems researcher to become an active participant in the "system of that system" (Reason, 1994, 1999). To report on this objectively requires the system to report on the system of reporting, as a form of second order cybernetic feedback (von Foerster, 2003). The additional act of describing or depicting the system as a commentator of system dynamics makes the researcher a biographer (or portrait artist) in representing what they are seeing. The effect on the seen, of the seeing, and its showing, is not ignored in mature systems research methods (Maturana, 1988). This awareness is reflected in the precision of the combination of choices of voice, tense, and stance that a systems research author adopts.

However, in systems observation and research, there is often no easily apparent "agent" to whom we can attribute the primary focus (Whyte, 1991). In the evaluation of systems research, use of the active reporting voice can make every declaratory statement of fact objectionable, if it is unverifiable (i.e., as opinion, not observation). Similarly, the default adoption of a passive voice to provide the illusion of distance (e.g., reporting on one's own community's learning) will provide only an appearance of impartiality from within a systemic intimacy (Maturana & Bunnell, 1999).

The question of research validity is actually determined by voicing accuracy. The ability to select a reporting voice appropriately is a mature research skill that applies beyond mere clarity of expression. Researchers must be cognizant of their "stance" relative to the system itself, if they are to make valid statements from an identifiable perspective.

For example, consider these sample sentences (as examples of combinations of voice, tense, and stance):

- The unsustainability of the recycling system is clear to all [active].
- The recycling system has been shown to be unsustainable [passive].
- The recycling system's unsustainability was due to its design [past].
- The unsustainability of the recycling system now becomes clear [present].
- The system will become unsustainable by the fact of its design [future].
- As designers, the recycling system fails our own criteria [participant].
- The recycling system's failure is its unsustainable design [commentator].
- The criteria for system sustainability were not met [observer].

We may have a preference for the voice that feels best to us. The correct form is the one that best describes the type of research completed. The actual choice of voice is determined by the research form used and the location adopted for the researcher's chosen perspective.

Suggestion

- Be mindful of the choices of voice when reporting systems research. Generally, one voice suggests one audience, one research role, and one primary perspective. A combination of voices may be required to accurately describe different stages, levels of involvement, and the perspectives taken during the research process. If mixing voices, signal each change in the report by using different sections and use that voice consistently throughout that section.

Choice of Complexity: Ontology, Hierarchy, and Humility

Often researchers are perplexed at the starkness of the contrast between how two peer-reviewers will perceive the same piece of research. While each may see obvious deficiencies and errors similarly, the reactions to the research can appear to be coming from completely different landscapes of experience. Using a systems understanding—of the understanding of systems—means your intuitive recognition of the difference in systems of perceptions is accurate. Not all systems researchers are seeing the same system similarly (Fischer, 1980). The communication of systems understandings can become like the appreciation of abstract art. The clarity of representation is partially seen in the eyes of the beholder (Gebser, 1985). For this reason there are technical difficulties specific to the communication of systems research and its abstract ideas (Dombrowski, 2000).

We can recognize from developmental psychology studies that adult cognitive development is not a homogeneous landscape of one universal type of thinking (W. G. Perry, 1999). The ways adults organize experience (i.e., post-formal

operational thought) does not support the assumption of a single uniform psychological system (Commons & Richards, 2003; Dawson-Tunik, Commons, Wilson, & Fischer, 2005). Independent of variations in intelligence, personality traits, and past personal experiences, the differences in operant systems of cognitive complexity means researchers will organize systems observations quite differently (Fischer, Hand, & Russell, 1984). For the researcher, this means that one audience is made of many minds. Two implications follow from this appreciation of audience diversity. The first is, not everyone is seeing what you are seeing. The second is, not everything you are seeing can be shown. In the communication of systems research this raises the question of choice in "ontological appropriateness" (Varey, 2014).

While characterizations of the same system by different researchers may be idiosyncratic to each researcher, the reason that systems descriptions can be communicated meaningfully at all is found in the premise that there are common features in the formation of adult abstract thought (Buckle Henning & Chen, 2012; Marton, 1981; Torbert, 1994). Actually, much can be known about how adults form abstract concepts (as is routinely done in the systems research field) from the research into developmental action-logics and the skill in forming abstractions in systemic reasoning (Cook-Greuter, 2000; Fischer, 1980). Informed by integrations in these research fields we can actively ask: How might systems thinkers knowingly organize their form of system thinking?

Knowing something about the systems of adult human thought will allow you to organize your research to communicate to different systems audiences appropriately. The question of how to "pitch" the complexity of your research will determine if your reporting accurately hits or completely misses its intended mark. To demonstrate this idea that the landscape of thought has discernible features and in-common categories, we can compare three hierarchies of developmental logics necessarily used in systems research (Floyd, 2008; Graves, 1970; Varey, 2007). These comprise existential motivations, self-other relations, and complexity of systems perceptions. Essentially, these are the "why look," "towards what," and "seen how" comprising the systemic logics of common forms of systems conceptions (see Table 6.3).

Table 6.3 Levels of abstractive systems logics

System motivation	Systemic relations	Systems perception
Ontonomistic	Reflective	Potentialist
Extensionalistic	Enactive	Synthesist
Experientialistic	Evocative	Dialectalist
Structuralistic	Descriptive	Contextualist
Relativistic	Representative	Constructivist
Multiplistic	Comparative	Organicist
Absolutistic	Collective	Structuralist
Objectivistic	Conative	Mechanicist
Ritualistic	Symbolic	Staticist
Autistic	Sensate	Automaticist

Adapted from "Ontological appropriateness: Relevance, significance, importance," by W. Varey, 2014, *Aspects of Apithology: The Journal of Apithological Practice*, *5*(2), 1–11. Reprinted with permission.

We appreciate from this broader landscape that different research motivations, for different systemic relationships, using different complexities of perception generate distinctly different systemic conceptions (Varey, 2012). Each conception relies on different ordering principles, altering the interpretations of distinctive levels of complexity. As a result each has a different ontology for their system of perceiving. The perceived reality (as it presents itself) is constructed differently, having different content available cognitively (Torbert, 1999). When communicating between orders of complexity, or making large jumps across levels of meaning, the impact felt is the problem of misconception. This often results in an unbridgeable chasm of lost meaning and unresolvable academic conflicts. The effect of a disjuncture between conception and perception is evidenced by the three most common problems in communicating systems thinking. These can be explained very simply as:

- *Conflation:* If one cognitive system extracts limited detail from a higher-order complex system selectively, while reducing the boundary of inclusion (e.g., "*this is essentially the same as X"*).
- *Abstraction*: If one cognitive system extracts limited detail from a lower-order complex system incompletely, while extending the boundary of inclusion (e.g., "*only Y is really significant*").
- *Reduction*: If one cognitive system extracts limited detail from a higher-order complex system specifically, while maintaining the boundary of inclusion (e.g., "*its all actually caused by Z*").

We can recognize that we will naturally re-frame complex information in ways meaningful to ourselves individually. Each systems conception engages in sense-making in different ways and represents complexity differently. From this understanding, when communicating abstract ideas the *informed* researcher will first appreciate their own system of systemic perceiving. The more *aware* researcher will also understand how others will recognize or misperceive the chosen framing. The *astute* researcher will actually select the systems ontology that meets the complexity of the system being researched. The *mature* researcher will use all of these skills to communicate the system perceived within the many systems of perceiving. The appropriateness of the choice of ontological complexity enables the remarkable to be described unremarkably. Not appreciating the impact of this choice may mean your research will vanish inconsequentially. The aim is not to make the obscure simple for all, it is to make the obscured clearly apparent, to those who care enough to ask and to know well.

Suggestion

- In systems research, care must be taken that the information you are making sense of differently is not a conflation, abstraction, or reduction of an existing and understood system of thought. The ideal aim of a systems research discipline is to develop the skills of the researcher to see systems with clarity and discernment. Reducing the necessary complexity to greater simplicity runs the risk of solipsism, where the system described is only apparent to one person—being the researcher personally. Being aware of the landscape of the many possible systems conceptions allows for our own humility in not depicting a specific ontological framing as the only possible interpretation and valid systemic reality.

Common Errors of Omission in Systems Reporting

> Between us, we cover all knowledge; he knows all that can be known, and I know the rest.
>
> – Mark Twain (on meeting Rudyard Kipling), *The wit and wisdom of Mark Twain*

Your ability to meet the necessary, sufficient, and elegant standards of systems research will depend on the good choices you made at the time the research is formulated, conducted, and captured (see Chapters 3 and 5). The subsequent evaluation of that research depends on it being accurately reported (see Chapter 8). The reviewers of systems research can only evaluate what has been spoken to directly. In the absence of clear information, questions about the basis for an assumption, the categories of exclusion, or the actual actions taken may have to be asked. While aiming to omit information in the interest of brevity, it is also a courtesy to be comprehensive and transparent in describing all necessary information and steps undertaken. It is reasonable for a reviewer to assume that information omitted is in actuality nonexistent. It is therefore worthwhile to consider the obvious errors and omissions in systems research reporting that detract from otherwise excellent research.

Using the structure of this book as a guide, there are familiar and easily identifiable systems research reporting errors (see Table 6.4). These common "errors of omission" are easily seen by the experienced reviewer. These will not necessarily be errors in the research itself, only omissions from the reporting process. Seeing these omissions specified (and named for easy recognition) may prompt you to check if (and how) your reporting speaks to each consideration. Any obvious omissions are then easily avoided in the writing up and reporting process.

Table 6.4 Common "Errors of Omission" for system researchers

Lineage overlooking (see Chapter 1)	Has the researcher used terms and concepts that have a long history of development correctly, referencing both historical and contemporary understandings, and explained the origins of any beliefs relied on—or used undefined terms ambiguously, relied on discredited or out-dated historical perspectives, and put forward an unsubstantiated view at odds with the consensus viewpoints?
Framework forcing (see Chapter 2)	Has the researcher said why they chose the framework selected, explained its choice compared to valid alternatives, and what the choice privileges attention to and also hides from the research—or did the selection of the framework precede the research question, without demonstrating a consideration of other options, and with no noted appreciation of its inherent limitations?
Answer proposing (see Chapter 3)	Has the researcher succinctly stated the research question, explained the context and situation, and outlined the research design process—or has the problem definition pre-supposed the given answer, without reference to the governing context, and no systematic approach to the actual process of the research?
Movable modeling (see Chapter 4)	Has the researcher explained the parts of the model, the boundaries of inclusion, the relations between the components, and the range of outcomes possible so as to consistently produce the outcomes expected—or are the model parameters, assumptions, operations, and predictions a depiction of a wishful thinking, justified only by a diagram that is too flexible to be reliable or useful?
Dynamics glass-casing (see Chapter 5)	Has the researcher explained the framework, method, and application (FMA), selected an appropriate form of intervention, and demonstrated the effects of their actions—or not adequately distinguished method and methodology, with no set process of recording variations, and offered no prospect for intervention?
Template replicating (see Chapter 6)	Has the researcher explained all the steps intended, the sequence of actions taken, and honestly reported strengths and weaknesses—or filled in generic descriptions of an often repeated or modeled process, without evidence of the actual research choices, and no reflections on the insights gathered?
Endpoint announcing (see Chapter 7)	Has the researcher demonstrated the skills for the system of research relied on, evidenced practice proficiency, and shown clear understandings with humility—or is the researcher confused about basic concepts, has failed to draw important distinctions, and neglected the next stages of investigation with no expectation of continuation?
Uncritical adopting (see Chapter 8)	Has the researcher put forward a credible (or even novel) contribution to systems knowledge, correctly applied systems ideas systematically, and thought about their research systemically—or adopted a systems narrative as a convenience (or contrivance), that does not assist the discipline, the research, or (ultimately) the researcher professionally?

If critical steps were not included in the research process, they are not recoverable at the reporting stage. Instead, the effective remedy is actually the preventative action of using this book as a guide. The choices made for *good* systems research design (set out in the other chapters of this book) will enhance the decision-making skill of each researcher. This is the best way of avoiding these errors of omission entirely. Finding an experienced person to guide you through these choices will facilitate the development of your own research judgment, discernment, and authentic engagement.

Some practical suggestions for early systems researchers to directly meet (or even prevent) each of these common errors, include:

- Lineage overlooking—in taking space and time to define the system, do not also neglect to situate the research in a relevant practical and historical context;
- Framework forcing—in adopting a framework, model, or systems heuristic, reference its originating concept (at source) and any deviations from this;
- Answer proposing—introduce the systems premise and its reasons early, so that the appearance of a system diagram in the conclusions is not unexpected;
- Moveable modeling—describing systems models in words is tedious, consider instead commissioning professional technical design and systems artwork to communicate the changing dynamics accurately;
- Dynamics glass-casing—a great benefit of a systems analysis is the possibility for systemic enhancement; therefore, in describing any dysfunction consider speculations (or specifications) for the system's enrichment;
- Template replicating—because different modalities have different reporting flexibilities, some newer fields willingly permit novel reporting conventions;
- Endpoint announcing—incorporate key systems concepts into the defining character of the research, using these knowingly and provisionally, as the primary (and iterative) focus for embodied systemic discovery;
- Uncritical adopting—when adopting a systems idea as a metaphor, isomorph, paramorph, or analogy, ensure the thinking behind the premise is shown transparently to evidence its relevance, appropriateness, and effective use.

Primarily, the objective of systems research reporting is to ensure the systems discourse is enhanced and the researchers themselves are encouraged. It is helpful for you to know what systems reviewers will look for in meeting these joint aims.

Ethical Considerations in Systems Reporting

> Education consists mainly in what we have unlearned.
>
> –Mark Twain, *The wit and wisdom of Mark Twain*

Systems Research Ethics

The systems research community commonly refers to its own discipline as the "systems sciences" (Flood & Carson, 2013; Klir, 2013). The research standards for scientific inquiry can be sensibly applied to systems research reporting. The National Academy of Sciences (2009) publishes a guide to scientific researchers on ethical values, scientific standards, scientific misconduct, and questionable research practices. The scientific standards for research generally poses the question: Are there other research and reporting ethics unique to the systems sciences?

To commence the consideration of this question we can propose three ethics specific to systems research and its reporting. These concern three features of the systems discipline, being boundary delineation, component identification, and framework abstraction. These elements logically form the three ethical risks of marginalization, universalization, and excision. A brief explanation (with a canon of conduct) is provided for each:

- *Risk of Marginalization:* The formation of a system inquiry loses relevance at its natural or explicit boundary of inclusive efficacy. In doing participatory consultation, those participating are sometimes assumed to be systemically representative, even if only of those who are the sole participants. The utility of a system investigation is constrained by its degree of separation from its strong and weak bonded external associations (Midgley, 2000). The solution is not to form ever-greater inclusions; rather, it is to accept for each study its specificity of non-inclusion.

  Canon #1: Necessary non-inclusions may be practical, political, pragmatic, or personal, and being ever present are always noticeable.

- *Risks of Universalization:* In identifying the components of a system, whether empirically, socially, or philosophically, there is a process of determining significance and insignificance. What is significant might be determined for a specific context by elements of culture, history, interdependences, and personal relevance. In identifying the *ideal* system these contextual inclusions may be generalized. The ethical risk for systems research is the universalization of findings from one specific instance to all conceivable locations (von Foerster, 2003). Although a systemic understanding from one context will rarely work in another without adjustment, simplified forms of generic applications make invisible the negation of local elements of importance. The solution is to replicate the integrity of the original systems inquiry to discern the inductive differences that are context specific.

  Canon #2: A generic universal framework hides as much as it discloses.

- *Risk of Excision*: The power of an accurate systems description is found in its capacity to provide a representation of the abstractive separated from the specific. The explanatory benefit of a precisely refined abstraction is how it holds the whole, while omitting almost all the detail. This is distinguished from the act of

"precision" (from the Latin, "to cut") where the abstract representation excises parts only for convenient examination (Peirce, 1957). When abstraction escapes from the necessary complexity, rather than representing it, the purpose of the systemic inquiry is lost completely. The solution is to ensure that all parts are represented in the new level of depiction.

Canon #3: Ensure details of significance are not ever negated, simply to fit our containers of contrived elegance.

Suggestion

- To think about the systems discipline as a science lends itself to being considered as such. Rather than convenient explanations, consider the rigor required to put forward independently verifiable observations and knowledgeable convictions. To support credibility, consider always the implication of later reliance, in making false claims of reliability.

Systems Research Heuristics

The act of describing a system, whether in an empirical model, rich picture, or simplified diagram, produces a representation. The production of systems artifacts involves a conscious choice of selection. In forming a system heuristic *some* of the relations, between *some* of the parts, representing *one* whole part (of a larger whole) are abstracted. This is designated (either verbally, diagrammatically, mathematically, or virtually) *as the system*. We recognize these systems diagrams as only ever being an approximation; merely a map, metaphor, or metonym. They represent part of the terrain of a more nuanced fuller reality. The cautionary adage, *the map is not the territory*, is often used as a precautionary qualification. However, the case must always be made for the relevance, accuracy, and sufficiency of our systems depictions.

Korzybski (1933), when outlining a formative version of the *Theory of General Semantics*, used the figurative metaphor of maps, specifically a metaphorical map to get from Paris to Warsaw via Dresden, to represent the structure of his complex abstract semantic argument (about semantics). To do this, he outlined four interrelated maxims, which read:

A. A map may have a structure similar or dissimilar to the structure of the territory.
B. Two similar structures have similar 'logical' characteristics…
C. A map is *not* the territory.
D. An ideal map would contain the map of the map, the map of the map of the map, endlessly. (Korzybski, 1933, pp. 750–751)

As Korzybski (1933) explained within this original essay, the problem is not really with maps; these are very useful. The problem is when the second criterion is forgotten, being the matching of the logical characteristics of similar structures. This makes our maps (and metaphors) potentially unreliable. Korzybski (1933)

warned that a map that becomes disconnected *in structure* from the underlying territory is in fact so "bad" as to be "misguiding, wasteful of effort" (p. 750) and in emergencies "might be seriously harmful" (p. 750). It is an irony that Korzybski's common quotation is itself an excision from the underlying structure from which it is taken.

Systems heuristics, especially those derived by vigorous and thorough investigation, contain great explanatory power. Their speed of adoption is often only outpaced by the compelling polemic of their persuasion. Whether climate models of sea-level rise, descriptions of ecological process, or systems diagrams of knowledge frameworks, our simplified depictions become the basis for decisions. Those decisions can have inter-generational impacts and far reaching effects. Consequently, much harm can arise from the adoption of simplistic mental models taken from the maps of false structures.

There is for each systems researcher an applied *ethic of representation*. The desire to create and provide a system heuristic as an easy explanation must not persuade you to distort the complex relations of the territory represented. The ethical standard required is not only to routinely warn of the qualified use of the unreliable map offered, but not to be the originator of a distorted topography (that can be used badly). By holding this precaution closely, each systems researcher may advance the ethic to preserve and enhance the landscapes of informed and reliable thought.

Suggestion

- Recognize the heuristic created to represent your research will be lifted from its context. Incorporate links to source, structure, territory, qualifications and timeframes so that the narrative adopted by others (and attributed to you as source) is not one to be later regretted.

Reflections and Summary

These reflections on the distinctive features of reporting systems research speak to what makes systems research so interesting. While systems research is mostly about having a set of paradigms, processes, and frameworks to follow, it is also a mindset to be cultivated. This mindset communicates an appreciation for what is easily seen partially, but is rarely seen in integrated ways, differently and uncommonly. Through our systemic inquiries we reveal aspects of the world unseen. In reporting these using a systems mindset, we embody the thoughts we are communicating. The great benefit of reporting our systems research well is that our research gets to be seen, and we are able to see ourselves revealed, equally.

While fragmented, disjointed, and incomplete research raises questions of coherence and introduces doubt, elegantly done systemic systems research has its own aesthetic and reliability. As a systems researcher you are encouraged to do your research accurately. From this basis, you may also learn to communicate your own

embodied expression of systems research competencies with confidence and personal clarity.

The advancement of science is often described as being about new discovery (Kuhn, 1974). The more recent recognition is the advancement of normal science mostly concerns the ability to follow routine methods consistently. Great advancements in research necessarily involve new horizons of perception and novel paradigms of investigation (Kuhn, 1983). A systems research approach potentially provides new understandings about the limits of our paradigms and systems of research routinely adopted. For each new vista of seeing, a researcher may have to develop their own rigor, in which they might be the first pioneer.

To encourage others to follow our own successful research examples, it is best not to announce early work as an endpoint conclusion, but instead, provide a path, bridge, and ladder into the new territories that others can investigate. Having a personal level of knowledge humility means our collective research endeavors will continue indefinitely. In announcing your findings, be bold, but not boastful; creative, but not careless; innovative, but not ignorant; and contributive, but not conceited. In this way, reporting your knowing astutely will benefit the system of humanity.

Based on this summary checklist, you will have done well in the role of systems researcher when in your research reporting you have:

- Taken a systemic approach to the design, recording, and reporting;
- Considered the location of your research in the *system of research*;
- Explained the system of research concordance by aligning five elements;
- Limited any validity claims to the boundary of the systemic inquiry;
- Followed a schematic for completeness of all necessary pre-requisites;
- Adopted a clear approach to choices of composition, tone, and balance;
- Taken into account ethical, professional and aesthetic considerations; and
- Provided a facilitative platform for favorable evaluation of the research.

In following each of these elements, you may have possibly communicated your completed research, so it can be seen as: *descriptive, situated, concordant, selective, sufficient, distinctive, authentic*, and *transparent*.

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