THE RESEARCH ACTIVITY SYSTEM AS SOCIOCYBERNETIC-SYSTEMIC FLOWS INDICATIVE OF AN EMERGENT COMPLEXITY IN THE CONDUCT OF HUMAN INQUIRY

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Abstract

Research processes comprise a general flow through phases of the research cycle. They may be described with sociocybernetic and systemic concepts. Praxiological decision making also informs researchers studying phenomena associated with human beings, human activities, and human organizations. Research activities can be mapped at different levels of complexity from the person to the human dyad to the small group to the larger human organization. There are several vantage points to consider, namely, the human participant, principal investigator, host institution, funding agency, ethics review board, and bystander. The various perspectives, phases of the research cycle, context and circumstances of inquiry, and levels of complexity form the substantive research activity system.

The Research Activity System

Within human organizational contexts, there can exist a kind of human activity system (Checkland, 1981), I term the Research Activity System (RAS). It is an emergent phenomenon indicative of complexifications arising in the conduct of human inquiry (Collen, 2003). The purpose of this paper is to consider major sociocybernetic and systemic aspects of research process that enable us to see and appreciate human inquiry as layered and emergent complexity. The RAS and the phases of the research cycle provide convenient foci; they are means to study and describe the complexities of human inquiry.

The RAS carries out research procedures that consume resources and have consequences, all of which merit inclusion in the planning and execution of inquiry for and with human beings. All too often limitations in thought, paucity of information and knowledge about how research process works, absence of systemic thinking applied to human inquiry, and changing circumstances while conducting inquiry bring about undesired and unexpected consequences. Researching under constantly changing conditions poses an ongoing challenge. Stakeholders, those who hold the RAS accountable for its activities, demand that research not be wasteful, trivial, and tangential. Making visible the layers of complexity involved in the conduct of human inquiry affords the RAS opportunities to steer research processes in constructive, efficacious, and productive directions.

Broadly taken, human science research process consists of research practices, procedures, strategies, methods, and methodologies in such disciplines as anthropology, ecology, economics, history, management science, political science, psychology, and sociology, in which human beings research other human beings. Research process may be considered a general form of human activity devoted to knowing, understanding, and ameliorating the human condition, and by extension to all related aspects of human affairs considered relevant to human subsistence, perpetuation, and development. Collectively, any set of research processes put into play for the purpose of answering a research question, testing a research hypothesis and fulfilling a stated

research objective, initiates an human sociocybernetic-systemic dynamic, the RAS, that soon takes on a life of its own as a system to consume resources, such as materials, human participants and money, and thereby generate products from inquiry, such as knowledge and know-how. If not a principal researcher, participant, supplier or funder, we become present as witness (bystander) to its activities or consumer of its products, for example a journal subscriber. Further, a RAS may become autopoetic, in that those who constitute the RAS, through their activities, may seek to perpetuate and replicate via programmatic research (Collen, 2003).

Two Useful Lenses

There are two perspectives that I have found very helpful to inform researchers engaged in forms of human inquiry. Whether actors or spectators in the conduct of human inquiry, these two views are particular lenses through which we see, study, engage in, and communicate research activities.

First, there is the sociocybernetic-systemic view. This view describes communication links among persons comprising a RAS, most centrally the researchers and participants engaged in human inquiry. For example, the feedback loop between the researcher and the researched forms an autopoetic subsystem we may depict in terms of first and second order reciprocal flows of information between and among them. Researchers ask questions, observe, and make requests of participants. Participants answer questions, perform, and respond to instructions. This loop makes it possible in most forms of human inquiry to collect the data needed to address research questions, hypotheses, and objectives.

Second, there is the praxiological view. This view is useful for the making of decisions that delineate research processes. For example, to conduct inquiry researchers must make the more efficacious use of resources to engage the researched in activities generating relevant data. The better research procedure that consumes a resource prudently within the time frame allotted for inquiry is a decision often critical to the successful completion of data collection.
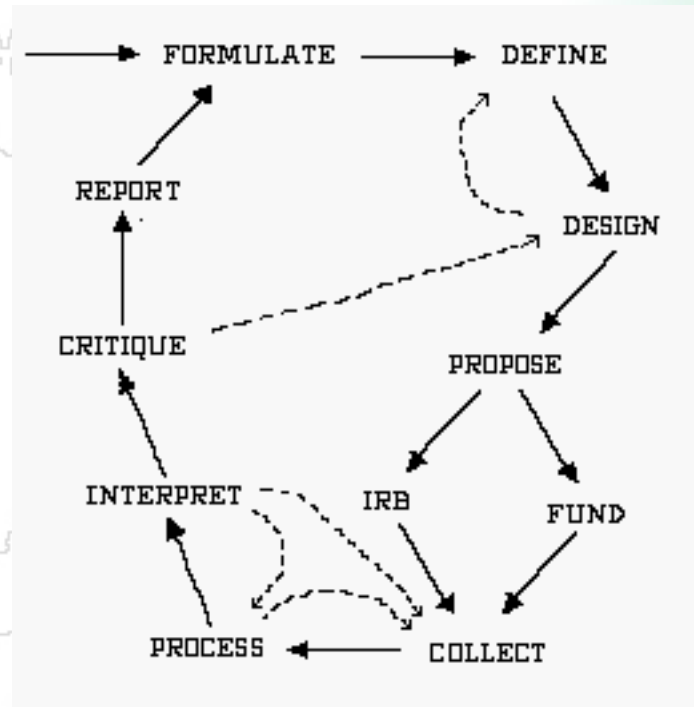
In the next three sections I discuss the general research cycle and links of the two perspectives noted above to it. Following that, I describe layers of complexity that can become evident to us in the use of these lenses.

General Research Cycle

Human inquiry may be described as a cyclical process that is ongoing, cumulative, and programmatic. One version of the cycle is shown in Figure 1 (from Collen, 2003, p. 198). The cycle consists of ten or eleven phases, dependent on funding. If we ignore the dashed lines connecting the phases for a moment, we may describe the general research cycle as a simple linear process from ÒformulateÓ to Òreport,Ó whereby one phase is completed before moving to the next phase. To communicate the sequence as a cycle instead of a linear chain of phases is to emphasis that concluding one inquiry with a report is the basis for the subsequent inquiry that logically and necessarily follows from the reported findings. Chaining phases works in a similar fashion as executing a series of inquiries (chaining research cycles). But within a specific cycle, one phase, for example doing a critical review of the literature, positions the researcher to make informed decisions for the next phase, to follow this example, to define constructs and select cost effective and ethical procedures for data collection. Looking ahead, the form of the research question adopted and the types of data collected point to what may be done to process the data to

answer the research question. A repeated series of such movements through the phases of the cycle, that is a chain of cycles, is one definition of a research program.

Figure 1
Feedback and feedforward loops of the general research cycle

The stated simplifications of course do not obviate the reality in most research institutions that several interrelated research studies occur simultaneously, a reality that markedly complexifies the research enterprise. The depiction (Figure 1) must be seen as only a basic and prototypical guide to assist researchers in carrying out a given research study.

Sociocybernetic-systemic Aspects

Although most researchers do not bother to explicate the sociocybernetics and systemics of their research, they will implicitly apply many of the concepts and principles comprising these schools of thought in the course of doing science. Whether they express what they do in sociocybernetic-systemic terminology, they must have some knowledge in some useful conceptual form and language equivalent to communicate relevant sociocybernetic-systemic relationships to fellow researchers, peers, and recipients of their research.

Familiar to cyberneticians and systemists alike, research processes for the discovery, production, and creation of knowledge may be described in terms of reciprocal relationships among those entities researchers conceptualize to define their processes of inquiry. Typically, these relationships are designated feedback and feedforward loops, both positive and negative, in reference to research process (Figure 1). These relationships are often taken-for-granted in human oriented research methodology. They inform theory and practice; they are inherent in the theory and conduct of inquiry.

In Figure 1, some communication loops are illustrated in terms of feedback (dashed arrows backward) and feedforward (solid arrows forward). Research process may be depicted as a general feedforward loop (the general cycle) with numerous feedback loops interconnecting its phases. The feedback loops shown in the figure are only representative. All loops depicted are of the first cybernetic order, but second order loops (Foerster, 1984) may be conceptualized linking one phase with others not immediately adjacent (Collen, 1996). The latter loops tend to be more reflective and anticipatory, where the former ones are direct engagements in implementing research procedures.

Naturally, the schematic is an ideal. This construction of the general research cycle serves as a general model or template applicable to various research traditions involving human inquiry. It does not mean that research must proceed through all phases to manifest the feedforward nature of the process. The description is one interpretation of the figure that seems to work for conducting inquiries across various science disciplines. Further, it does not mean that every research study must have precisely these phases to qualify as scientific, or that the same feedback loops define all forms of inquiry. Specific studies will lead to some variations in the cycle. Despite its shortcomings, the cycle metaphor and its schematization in this form have proven to be highly useful for planning, proposing, pedagogy, critique, and meta-analytic cross comparisons within a body of research reports.

It is worthwhile noting that separations between adjacent phases often are blurred, depending on the variation of research method employed (Collen, 2003). Further, working simultaneously on aspects of various phases often brings into question the generalization of such a prototypical cycle for all inquiries. The researcher usually has a bearing on where in the cycle the investigation lies, regardless of the ambiguities of going from one phase to the next. Finally, whether the outcome of the cycle is a negative (-) or a positive (+), the feedforward contribution to programmatic research can only become known in hindsight.

With this general idea of the cycle in mind, from a sociocybernetic-systemic view, we can appreciate the conceptual preoccupation of researchers engaged in the process. It begins when researchers push into the foreground of consciousness a preoccupation with the topic area, problem focus, and research questions. With some formalization in the first phase, the project enters into operationalizing and consensus building among inquirers, followed by designing and planning. Thereafter, the research proposal becomes the more salient task. As the proposal takes shape, funding and ethics review become salient concerns. Then the emphasis shifts to implementation. Data streams require recordation, organization, and processing. Processing preoccupies researchers with analyses followed by syntheses to render cogent findings that hopefully can be contributive and applicable. Forms of reporting back to those who have vested interest in the inquiry entails the latter portion of the process, which also positions researchers to reinitiate the cycle once more.

Characteristically, earlier phases drop increasingly into the background as the inquiry proceeds around the cycle. Like the motion of an oceanic wave, there is a swell from the context of the focal phase to define the foreground as the previous phase recedes into the background. The wave metaphor conveys this movement, to which the helmsman may be added. The researcher as cybernaut steers inquiry through the simultaneous push-and-pull of the phases that brings past and future influences, respectively, into the process. Hence, a given research study can best be conceptualized and understood as a wave cycle. During inquiry, the phase at hand dominates the inquiry. Previous phases (feedback) serve the researchers to adjust (push) the process, while impending phases serve to draw (pull) the researchers forward in the process.

Taken together, the push-and-pull enables researchers to steer, in the cybernetic sense, the inquiry through its cycle.

Moreover, from the sociocybernetic-systemic point of view, each phase has important second order relations with every other phase. The researcher becomes increasingly aware of these systemic relationships as experience is gained in doing research, such that work done in any single phase is examined for its impact on all other phases. Engagement in any one phase may be informed by drawing upon expertise, previous experience, and resources available in regard to all phases. Holistic, dynamic, and process oriented aspects of the cycle become evident and meaningful to researchers. While we must attend with saliency to the feedback loop between one phase and its immediate predecessor, particularly during the transition between phases, all the while, we also remain receptive to other feedback loops from other phrases, those completed as well as those anticipated. Experienced researchers monitor and exploit these linkages most advantageously to expedite inquiry.

Praxiological Aspects

Researchers make many decisions about the use of resources (persons, funds, material resources, and time). Decisions mean actions, not only in making decisions, but also in implementing them. Decisions entail the efficiency, effectiveness, and efficacy of action (Kotarbinski, 1965), also known as the three main Es of praxiology (Collen, 2003). Researcher decisions bring pragmatics to bear on researcher actions. They tend to emphasize the practical and consequential nature of action.

Arguments in favor of contemporary praxiological decision making include the ethicality of action, specifically, the ameliorative and detrimental consequences on others and the environment (Collen, 1999). Although a focus on the triple E of praxiology, the practicality of efficiency, effectiveness and ethics (Gasparski and Ryan, 1996), may be expanded to other Es, such as education and evaluability discussed in detail in Collen (2003), the point here is that to apply the conceptual scheme of Es to human inquiry complexifies human inquiry. The many seemingly smaller praxiological decisions at any given phase of the general research cycle can have larger consequences on the course of inquiry.

The relevance of the Es is perhaps most vivid when directed to each phase of the general research cycle. Table 1 (from Collen, 2003, pp. 209-211) shows some representative decisions to be made at each phase. For example, the choice of instrumentation, noted under ÒdesignÓ in the table, typically involves a nexus of the following considerations: Consultation with its creator; transactions with its owner and supplier; knowledge of its validity, reliability, and impact on human beings; experience and know-how with its administration; recording, scoring, and interpretation; and versatility for data processing. To consider one more example, the division of labor among researchers to collect the data, noted under ÒcollectÓ in the table, varies widely in research practice. There is frequently formed a team of primary data collectors, who are supervised by a principal investigator. Training and careful coordination for and during data collection are required by the principal to ensure its reliability, validity, and usability across samples (data collectors). Similarly, we can discuss many other decisions in the table, but the exact decision to be made always goes to the level of the particular research study.

Table 1
Examples of practical decisions to be made at each phase of the general research cycle

FORMULATE
Choice of problem area and focus within it.
Choice of knowledge domains.
Choice of level and perspectives of the subject matter within the problem area.
Choice of several research questions and hypotheses, constituting a family of research aims, each
of which may suggest a slightly different direction or emphasis for investigating the
phenomenon.

DEFINE
Choice of several viable and theoretically anchored definitions of the same hypothetical
constructs.

DESIGN
Choice of several valid and reliable instruments available to operationalize a hypothetical
construct, thereby enabling the researcher to make observations and measure the phenomenon.
Choice of several research designs to configure the persons, resources, and time required for
conducting the inquiry.

PROPOSE
Choice of formats and items to comprise a complete research proposal.
Different formats, level of detail, and specific appendices according to the requirements of the
source to which the research proposal is being submitted.

FUND
Set of forms particular to each funding agency.
Details and appendices particular to the requirements of the source to which the research proposal
is being submitted.

IRB
Variations on the application forms to that the research procedures to be applied incorporate
sufficient safeguards for the protection of the human participants to be used for research
purposes.
Different categories of review depending on the extent of contact with human research
participants.
Possibly more than one review depending on the number of institutional sources required to
collect the data.

COLLECT
Choice of several plausible sampling plans to select the persons who manifest the phenomenon
under study.
Choice of multiple participants and repeated contact with the same participants.
Choice of several times of the day, days of the month, and months of the year to make
observations and collect data.
Choice of several places to make observations and collect data.
Choice of researchers, taking into consideration their research competencies, experiences and
proficiencies, their familiarity with the phenomenon under study and methodology to be used,
their epistemological orientation, and other personal characteristics relevant to the inquiry.

PROCESS
Choice of several means to code, organize, and process the data collected.
Choice of multiple qualitative and quantitative indices to analyze and synthesize the data, answer
research questions, and test hypotheses.

INTERPRET
Choice of multiple interpretations of the findings.
Range of findings from interpretable to uninterpretable.

CRITIQUE
Choice of multiple theories that seem to account for or refute the findings.
Choices among possible presentations to debate the critics.
Choices of direction for future research based on the findings.

REPORT
Choice of organizations and formats to place and present qualitative and quantitative indices and
   their associated findings in the report.
Choice of several organizations and formats to describe and present the project.

Complexification in Research Process

Allusions to complexification in research process have been made in previous sections. In this section, I discuss complexification as an emergent phenomenon inherent in doing research.

Even though the general research cycle is the frequently taken standard and ideal that assists researchers in formalizing ways of doing human inquiry, in practice, multiple variations exist. Comparisons and parallels of the cycle to expressions of the Kolb cycle are evident (Collen, 2003) as well as other research traditions, such as the hermeneutic circle (Collen, 1995b). The fact of these variegations suggests a richness we might expect from complexification. In fact, such methodological diversity is more the rule than the exception. Differentiation of forms of inquiry is especially apparent, and increasingly controversial, as researchers form distinguishable and successive arenas of inquiry, each indicative of a cogent set of paradigmatic assumptions that influences their multiplicity of interests (Collen, 1995a; Oliga, 1988). Complexifying matters even further, differentiation within each paradigmatic arena has led to a multitude of research traditions. The methodological diversity is evidenced in and helps to explain the many forms of human inquiry today that may be applied to the study of a single human phenomenon.

The penultimate in complexification seems to be undertaking research that boldly transgresses paradigmatic arenas to mix research methods, resulting in more complex constructions of methodology that converge seemingly disparate traditions involving qualitative and quantitative data collection and processing procedures (Brewer and Hunter, 1989; Tashakkori and Teddlie, 1998). With each generation of researchers, they appear to act with less obligation to adhere to their incipient indoctrinated research tradition. Perhaps this trend is justly advocated, because the globalization of humanity has brought the omnipresence of the human element in all aspects of life on this planet. One research tradition and one paradigmatic arena seem increasingly inadequate to provide adequate answers to the research questions we pose. Researchers in all paradigmatic arenas of human inquiry are making greater use of multiple research methods to follow our growing awareness of the complexity of local to global phenomena and human activity. Trends compel us toward more complexification in methodology and disciplinarity (Collen, 1992 and 2002).

As an inquiry advances through the research cycle it complexifies. What does this mean? Researchers tend to focus deliberately upon the dynamics of one phase to conduct inquiry, while those phases before it bear some influence upon the decisions made in that phase. As the phases accumulate, the inquiry, like an avalanche, carries more weight ÐÐ there is more at stake ÐÐ bearing down upon the culminating research cycle. Let us consider one example in the middle of the cycle. Selecting the vehicle to gather data, or make observations, is influenced by the nature of what one is looking for, that is, the evidence that answers a research question or tests a research hypothesis. There may be several choices to consider. Each choice likely has been used

before, so that there is information available to make an informed choice regarding the validity, reliability, efficiency, expense, and ethicality of the means of data collection. Such is the case in the choice of an instrument, survey, observational technique, and type of research interviewing. Where the form of the question posed may have seemed to be a relatively simple task in the early phase of inquiry, it soon becomes apparent to the researcher that there is a plenitude of choices for means to answer the question. The emergent complexity may quickly overwhelm one with too much information. The researcher has to sift carefully and systematically for the critical information needed to make an informed choice.

Back to the earlier phase provides a second example. The focus for inquiry in its formulation is often rather general. The researcher must concretize the focus from a general research question into a family of related questions or hypotheses, that taken together, cover substantively the focus to justify the use of human beings and resources for research purposes.

Putting the two examples together we can see a conceptual tree-type diagram unfolding, demonstrative of complexification. The divergence apparent from the general question to specific questions and hypotheses, and then to choices for data collection for each question and hypothesis mushrooms the course of inquiry into a sizable undertaking. The skill of the researcher must come into play to find ways to convergence and economize all decisions to keep some semblance of comprehensibility over the process. Further, the decisions must not jeopardize the research process by shorting the means of data gathering, such that insufficient information is gathered to address any particular question and hypothesis. Hence, the experienced researcher seeks proven strategies to assist one in decision making, such as utilizing one instrument that yields data addressing many questions, in contrast to the obviously inefficient and wasteful use of one instrument for each question. Moreover, using multiple measures to address a question, that is convergent operations, brings a power to inquiry that cannot be surpassed. Thus, a balance is often sought among strategies for praxiological decision making that maximizes gathering relevant data and minimizes expense and waste.

Experience in praxiological decision making also brings insight into the layers of complexity inherent in research process. The most elementary level consists of the many specific decisions to be make at each phase of an inquiry, such as the sample shown in Table 1. But it soon becomes apparent to the experienced researcher that the decisions are not autonomous. They are interdependent. A web of relations exists that defines and influences the course of any inquiry, as suggestive in the feedback and feedforward links shown in Figure 1. This second layer of complexity suggests a large array of possible constructions from the individual decisions made over the course of an inquiry. This fact is nicely illustrated when one gathers together several research reports (replications), for example, to conduct a meta-analysis. To illustrate a common candidate for meta-analysis in the psychological and health sciences, consider this key question: Does Therapy X (or Medication Y) diminish the symptoms of the human malady to the extent the person can function within the expected range of behaviors without requiring professional assistance? Each study cannot be exactly the same as the others, because of the decisions involved that define any specific inquiry. Yet the set of studies provide a body of research targeted to answer the same research question. It does not take much to stretch the imagination of the researcher to realize there is a third layer of complexity in doing research. This layer involves the research strategies to put into play the other two layers. All layers taken together provides the researcher with an intricate comprehension of research process.

Reflections and Conclusions

Human science research is productively conceptualized as a general feedforward loop (cycle) comprised of between phase feedback loops. The sociocybernetic-systemic view and praxiological decision making, two perspectives or lenses, inform research process. These concepts and views converge to complexify human inquiry, any specific form of which may be described as a RAS. What is learned once through the research cycle provides the base for the next time through it. Programmatic research in particular is favored. Long range thinking about human inquiry contrasts sharply with dependence on the singular investigation for results that are expected to give the answers, test the hypotheses, and point to applications for human betterment. Rarely, if ever, can a single inquiry meet the ultimate expectation.

As researchers gain an understanding and appreciation of complexifications in human inquiry, such expertise makes it easier to ask and answer such questions as: What interactions would one expect to expedite the feedforward movement of inquiry? What cooperative and collaborative human relationships are required over the course of the inquiry? What possible interactions may occur among the phases of the research cycle to complexify research process unnecessarily, that is complicate research process? Research endeavors typically require a team effort (e.g. the principal researchers, participants, research assistants, suppliers, funders, and administrators). Knowledge of the role each contributor makes to successful inquiry brings a further recognition of the complexity emergent in the course of any research undertaking.

In the general methodological approach taken in this paper to consider complexifications inherent in research methodology for human inquiry, there appears to be a fruitful convergence of praxiology, pragmatism, sociocybernetics, and systemics. Connections are implicit between acts of decision making characteristic of human inquiry (praxiology) and the consequences of executing them (pragmatism). Connections are also implicit between decision making (praxiology) and human relations of each phase of the research cycle (sociocybernetics). Any holistic expression of research process in action may be described as a RAS (systemics) that today may stem from any one or more research traditions and paradigmatic arenas of human inquiry.

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