EXPERIMENTAL METHOD WITHIN SYSTEMS METHODOLOGY: THE CASE FOR AND AGAINST

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ABSTRACT

The experimental method dominates still most of mainstream science. Even with its general limitations, there can be some competent interface with systems methodology. This interface is described and applied to the human sciences. Some conditions in which both experimental and systems inquiry are compatible are contrasted with those in which they are antagonistic, even counterproductive. Control and complexity are thought to be two key considerations in deciding whether experimental method is to be included within or excluded from a systems methodology. Selective examples, particularly from human activity systems, serve to reinforce the case for and against the use of experimental method within systems methodology.

INTRODUCTION

While the systems perspective shows a greater following and the scientific literature brings recognition to systems thinking, theory and methodology, the vast majority of scientists continue to follow an empirical-rational-analytic-reductionistic approach to disciplined inquiry that typically makes use of experimental methods. The resistance to acquire the knowledge and competence necessary to engage in systems inquiry speaks to the strength of early and ongoing success with experimental methods. Many forge ahead applying experimental methods to every area and problem of human interest.

However, a growing stream of publication and debate has challenged the wide spread use of experimentation, on philosophical as well as pragmatic grounds (Harre and Secord, 1972; Manicas and Secord, 1983; Rosnow, 1981; Sarason, 1981).

In contrast, there are others who favor an alternative, namely systems methodology (Checkland, 1981; Reason, 1980). They believe it to be a more productive means of studying and ameliorating human affairs.

The purpose of this paper is to articulate some conditions when experimental method can work within a systems methodology and when it can not. Yet, just as there is no necessary union or incompatibility between the two, there is reason to believe that for human activity systems, systems methodology is not a replacement for experimental method, but is an advance over its more traditional uses, especially in more complex human activity systems.

Because systems methodology is broader in conception than experimental method, it will be dealt with first, followed by experimental method second; afterwhich, the purpose of this paper can be fulfilled.

SYSTEMS METHODOLOGY

A system consists of a collection of elements in interaction. A human activity system is a group of human beings whose communications are directed toward some goal or objective. This dynamic is historical and evolutionary. Common examples are our social, economic, educational, and political institutions.

A systemic method is a formalized means of studying a system. Systems methodology is the study of such methods, as well as the collective applications of such methods to the study of a human activity system.

To be identified as a systemic method, it is derived from a world view frequently expressed in terms of systems thinking. It makes use of the interactions of the elements or parts of a system in order to focus on the behavior patterns of the system as a whole. Recognition is given to the dynamic, complex, evolutionary, and holistic nature of the system. Interest also centers on the emergent and integrative qualities of the system.

Several group process techniques, modeling, monitoring with technology, and data collection and analysis techniques can assist the researcher in maintaining a focus on the system as a whole over time. These tools are of the type which contribute to the development of a systems methodology. There are various interests among investigators either to construct, develop, monitor, model, or modify the system over time (Checkland, 1981).

EXPERIMENTAL METHOD

As a means to study a human activity system, experimental method comes from a world view characterized as analytical, reductionistic, static, and linear. A system is considered an entity whose disection can unravel the mysteries of the whole system. Systematic inquiry breaks the system down into its parts. The parts are studied separately, and in small combinations. Typically, experimentation entails the removal, incapacitation, or stimulation of individual elements.

Through deductive reasoning, hypotheses are formulated. Through inductive reasoning and inference, hypotheses about the elements are related to each other.

The research is designed and carried out in a time bound fashion. For example, a pretest is given, the system is obstructed or altered, then a posttest is given. Changes in the elements from pretest to posttest are infered via quantitative analyses of the observations collected at the times of testing. The system is neither monitored between tests or as a whole.

Replication of the changes through repeated testing on ocassions when a change is imposed (intervention) and when it is not (control), eventually leads the researcher to stable, consistent findings. With such results, the investigator attempts to make inferences regarding the structure and functioning of the system. It is in this manner that theoretical models and reductionistic explanations are constructed and tested (Kaplan, 1964).

INTERFACE

At first examination it would appear that experimental methods are incompatible with, even antithetical to, systemic methods. Each type of method emerges from contrasting world views. Where a systemic method is premised on maintaining the integrity of the system, an experimental method is employed after a premeditated subdivision of the system into experimenter defined parts. Where a systemic method tends to generate interaction patterns among all elements to provide a picture of global functioning, an experimental method intensifies inquiry to the behavior of specific elements and their communication with neighboring elements. Finally, where a systemic method seeks ideally to monitor continuously the developmental changes of the system, an experimental method yields a static and time bound assessment of the elements.

Although these distinctions begin to clarify some potential difficulties in the use of experimental methods within systems methodology; paradoxically, they also give promise to some potential complementarities.

Incompatibilities

But first, it is easier to articulate some incompatibilities between the two methods than their compatibilities. The analytic, reductionistic character of the experimental method has been developed to an extreme from logical positivism. Operationism of variables is one aspect where these characteristics become evident immediately, especially in the narrow definition of individual variables. The classic example is the univariate case in which one independent variable, typically a stimulus or treatment, is introjected into the setting by the investigator; then its impact is assessed by means of one dependent variable, typically the frequency or magnitude of an overt physical or verbal response. The objective of the research is to establish a causal link between the two variables seen in much the same way as the physician's rubber hammer and the patient's knee jerk.

Studying human beings in a social, corporate, or educational setting as a single behavior in response to an environmental change is unrealistic. Focus on a few select variables, one being a single index to monitor one or two elements of the system, yields a very incomplete and oftentimes distorted view of the system. The level of complexity of the problems and social interactions appear to make it untenable for an investigator to utilize an experimental method. Attempts to study institutions in this fashion can lead to inquiry which is contrived, simplistic, intrusive, reactive, and cost ineffective (Cook and Campbell, 1979; Mowday and Steers, 1979).

The complexity of the system studied and the intrusiveness of the method can pose severe limitations in the use of experimental methods. When interventions into the system are viewed as controlling and contrived, use of experimental method is usually problematic. For example, changes in procedures, responsibility, even simple surveys can engender distrust toward coworker or employer, raise anxieties about competence and job security, and set off waves of gossip which subtly alter the corporate climate.

Furthermore, it is usually implausible to generalize findings of experimental research from the elements to the whole system. Improving the safety of a product, for example, may improve the morale of those on-line workers in the manufacturing plant, but it does not automatically raise the morale of the marketing division or the company as a whole.

To deal with the complexity of systems, systems methodologists tend to utilize means to monitor the system, or alternatively develop models which mimic or simulate the system. With this information accumulated over time, the researcher attempts to describe the structure and functioning of the whole system. These preferences of systems researchers differ from tendencies of experimentalists who analyze the system immediately into its parts, manipulating the parts in various experiments with the long range objective of reconstructing the system and forwarding theoretical accounts.

It appears that where an experimental method finds out much more about particular elements of the system and much less about the system as a whole, especially its emergent properties, a systemic method finds out much more about the whole of the system but much less about the individual elements. In both cases, the end or objective of inquiry can be the same, but the means to that end differ. Perhaps, one reapproachment between

the two methods may be a comparative systems analysis (Troncale, 1982).

Compatibilities

The apparent gulf between experimental and systemic methods begins to diminish when the experimentalist recognizes the systemic nature of the elements he so keenly isolates in order to conduct his work. Systems thinkers pride themselves on viewing the world as an intricate network of systems intertwined in horizontal, subordinate, and superordinate relationships (Laszlo, 1972). Regardless of how analytical the experimenter chooses to become, from the systemic perspective, the basic elements of study, be they people, groups or institutions, constitute a system. The experimenter is always studying a system how ever he intentionally neglects to relate it to the others in horizontal, subordinate and superordinate relationship with it.

One area in which both systemic and experimental methods have cooperatively furthered our knowledge is the neurosciences. Much has been learned about the human brain through systematic experimental removal, transection, and electrode stimulation of various cells, nuclei and neural pathways (Gazzaniga and LeDoux, 1978; Thompson, 1967). These experimental techniques have been invaluable in teasing out the functional significance of numerous hierarchically and heterarchically related subsystems of the central nervous system. Generally, the objective has been to interface the analytic and integrative research toward comprehension of global neural functioning of human beings in a multitude of settings and on a large variety of tasks. Thousands of cases involving brain injury from accident, war, and disaster are important corroborations of laboratory studies, and vice versa.

At a psychosocial level, research on family dynamics and some aspects of family therapy provide a second area of complementarity of experimental and systemic methods. There has been much interest in studying and working with the family as a social system (Framo, 1965; Selvini Palazzoli et al., 1978; Watzlawick et al., 1967). The experimental method recommends the intentional manipulation of 1) physical presence and absence of family members and 2) the types of communications which are introjected or withheld by the researcher (practioner). In this manner, the researcher (practioner) can study the system, determine its psychopathological manifestations, and work to ameliorate problematic communication patterns within the family unit.

In each of these examples, although the focus may be initially on specific neural nuclei or family members and their interactions with adjacent elements, there is progressive, systematic movement toward synthesis. Emergent qualities of the system are of particular interest. The goal is satisfactory comprehension of the whole system. The systems perspective remains, from beginning to end, the everpresent guiding light over the course of inquiry.

The experimental method is known to be more effective as a means of inquiry under controlled conditions. Within a systems methodology, this would be so as well. Fortunately, many systems exist outside the laboratories of physical, biological and behavioral scientists. Many of our social institutions, schools, businesses, and industries occupy physical plants which are highly bureaucratized into many interconnecting levels and work units. People perform within their assigned and restricted physical spaces. They use various media, most notably the telephone and the memorandum, to communicate with other units of the system. Each unit can usually communicate with other units in horizontal, subordinate and superordinate relation with it. This contemporary fact of working life makes a very suitable context where experimental method can work in the service of systems inquiry, especially since organizational change is just as endemic to working life as bureaucratization.

CONCLUSION

Given their historical and epistemological underpinnings, the experimental and systemic methods would appear conceptually ill suited, in fact mismatched for conjoint disciplined inquiry. On the one hand, this seems to be so under circumstances where control and manipulation of the elements are impractical, even disruptive, and the system is quite complex. In such cases, the two methods work at cross-purposes, and it is best to exclude experimental methods from systems methodology. On the other hand, the compatibility of the two methods can be reinforcing. Experimental method seems to be more effective when the structure of the system tends to be simple. The method can have pragmatic value. When circumstances are highly restricted, contrived and/or controlled, and manipulation of the elements are common, the experimental method can be an important part of a systems methodology.

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