Action Research: An Exploration of its Logic and Relationship to the Scientific Method

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This paper considers those interpretations of action research that can be traced to Kurt Lewin at the Research Center for Group Dynamics at the University of Michigan, and the work in social ecology by Emery and Trist at the Tavistock Institute. It locates the logical basis of these interpretations in the philosophy of pragmatism, particularly as it relates to Peirce's inferential logic and inquiry system. An outcome is the argument that both positivist science (which relates to closed systems thinking) and action research (which relates to open systems thinking) are both essential to any complete scientific approach.

Introduction

Reason and Bradbury (2001:3) observe that while many writers trace the origins of action research to "the social experiments of Kurt Lewin in the 1940s" and the "socio-technical experiments begun at the Tavistock Institute….there are others, which deserve acknowledgement". Consequently Reason and Bradbury correctly observe that:

"*...the term 'action research' has been used in so many different ways that the term has lost some of its original weight. Sometime it is used to describe positivist research in a 'field' context, or where there is a trade-off between the theoretical interests of the researchers and the practical interests of organization members; sometimes it is used to describe relatively uncritical organizational consulting based on information gathering and feedback… The action research family includes a whole range of approaches and practices, each grounded in different traditions, in different philosophical and psychological assumptions, pursuing different political commitments.*" Reason and Bradbury, 2001: xxiv.

In this paper we concentrate on those origins of action research attributable to Lewin and the Tavistock Institute.

There have been many attempts to establish the "scientific" credentials of action research. The usual approach is to first set down a set of basic tenets of

scientific research and then compare action research to them. In most instances this version of scientific research is synonymous with one or more variations of positivist science. Blaikie (2004: 837) identifies three key versions- Comte's original version formulated in the first half of the 19th Century; logical positivism, formulated by the Vienna School in the 1920s; and a current "standard form" based on the tenet that phenomena must be explained as a specific case of a "covering law" and where explanation is based on observation resulting from objective research and the formation of refutable hypotheses.

Such an approach to comparison is doomed to fail because the test is constructed from the relatively narrow perspective of positivist science; narrow because positivist science does not entertain taking action in the broader world and in doing so attempts to exclude the importance of values in science and the possibility of changing contexts.

Two contemporary examples illustrate the shortcomings of positivist science when action is taken or at least contemplated. The first relates to newspaper reports (The Weekend Australian, August 18-19, 2007) concerning calls for a review of Australia's system for monitoring widely used medications. This follows the withdrawal of a drug for the treatment of arthritis that has been linked to liver failure. This has occurred despite the development and trialing of the drug under the most stringent "scientific" conditions.

The second example relates to the call by NASA's top climate scientist, James Hansen, to take action on climate change before all the facts are agreed. Hansen (2007: 32) writes:

"*…skepticism is at the heart of the scientific method and discovery. However, in a case such as ice-sheet instability and sea level rise, excessive caution also holds dangers*".

In each case we observe that when faced with the practicalities of action, positivist science is inadequate and we find ourselves either taking action, or at least contemplating it, on the basis of "inference to the best explanation" (Lipton, 1991). That is, a "best" hypothesis is formed and corresponding action taken in the context of monitoring, intervention to make adjustments, and eventual evaluation.

This process was described in logic by the American founder of pragmatist philosophy, Charles Sanders Peirce (1839 – 1914) and in this paper, it is argued that Peirce's triadic logic underpins action research and helps identify action research and positive research as complementary aspects of a more complete scientific method.

The importance of action research to systems thinking practice has become increasingly recognized (Checkland and Holwell, 1998; Flood, 2001) and Barton and Haslett (2006) have demonstrated how adopting the principles of action research can enhance particular systems methodologies, specifically, system dynamics.

Lewin's Action Research and Some Later Extensions

Blum (1955) provides one of the most useful accounts of Lewin's practice of action research at the Research Centre for Group Dynamics, University of Michigan, in the period 1945 – 1955. Blum (1955: 1) defines Lewin's action research as meaning "diagnosis of a social problem with a view of helping improve the situation. All action research has, therefore two stages:

1. A diagnostic stage in which the problem is being analyzed and hypotheses are being developed;
2. A therapeutic stage in which the hypotheses are tested by a consciously directed change experiment, preferably in a social "life" situation".

Blum argues that the inclusion of the second stage is the key differentiator from positivist science with fundamental consequences for the "overall research design, the methods and the techniques used".

Foremost amongst these implications is for the action researcher to develop a "mutual relationship" with stakeholders with possible consequences for objectivity and ethical behavior. In the therapeutic stage "people take part in an experiment which is consciously directed towards the implementation of certain values" (p.2). Consequently, Blum argues that "ideally action research should be undertaken by a team small enough to function as a group but which is sufficiently large to represent different (a) personality types (b) social values and (c) talents" (p. 3).

Blum identifies the main objection "which the action researcher has to meet squarely is that he confuses his role as a scientist with his role as a human, social, political and ultimately a religious being that he ceases to do objective research as he becomes entangled with the world of values" (p. 40). But he goes on to emphasise that positivist science is not immune from these issues: "values penetrate the whole conceptual framework since they affect such fundamental choices as between 'data' and 'variable'. They also determine the orientation of the whole structure of thought toward certain *problems* and hence the *meaning* of all theory" (p. 5).

The implication of Blum's account is that we need to adopt a more holistic approach to the scientific method and move away from a position that sees positivist science as "rigorous", where rigour is defined in somewhat circular terms within the bounds of positivist science, and action research is seen as not being rigorous.

Unfortunately, as Reason and Bradbury (2001) point out, there are many variants of action research, and not all involve the rigour involved in the processes developed by Lewin. In response to this situation Argyris et al. (1985) introduced the term "Action Science" - a *science* of human action in an attempt to bring action research back to its integrative roots as described by Lewin. In particular, Argyris et al. (1985) addressed the question of objectivity by recognizing three objectives as fundamental to Lewin's approach:

- Learning is the first and overarching objective;
- Any knowledge produced should be formulated into empirically disconfirmable propositions;
- Knowledge can be organized as theory.

In these terms they reinforce the distinctions made by Blum by arguing that attempting to use "standard scientific research" in the social sciences may be "self limiting":

"*We would be content to use the term "action research" if it was not for two factors. First, over the years action research has often been separated from theory building and testing. Leading social scientists distinguish action research from basic research by asserting that the intention of action research is to solve an important problem for a client and not necessarily to test features of a theory…. Second, many action researchers understandably conduct their empirical work by following the current ideas about standard scientific research. The dilemma is that some of the currently accepted ideas of rigorous research may be self-limiting*" Argyris et al., 1985: x.

Argyris et al.'s (1995) approach is an elaboration with a specific emphasis on implementation of Argyris and Schon's two theory-in-use models (I and II). Model 1 theory-in-use corresponds to a form of bounded rationality (Simon, 1964/1976) in which people impose their own meanings on action and become dogmatic about them. Consequently, it becomes difficult for them to openly reflect on their motivations and actions and they become defensive in conversation. Model 1 is also consistent with a closed-systems view of the world in which contexts and environments are locked out (Argyris, 1983: 120).

The capability of being able to effectively reflect on actions and motivations involves the adoption of Argyris and Schon's Model II. These two modes of learning have become popularized under the headings of single and double loop learning (Argyris and Schon (1974, 1978, and 1996). (Argyris (1983) provides a succinct version of the action science perspective). Flood and Romm (1996) have added a third element of critical reflection that raises issues of power and systems of meaning and hence raises deep ethical considerations; triple loop learning. Checkland and Holwell (1997: 12) have further contributed to the development of Lewin's model by identifying from Argyris et al (1985) four "crucial elements in a research approach which works within a specific social situation:

- A collaborative process between researchers and people in the situation;
- A process of critical inquiry;
- A focus on social practice, and;
- A deliberative process of reflective learning".

The important contribution that Checkland and Holwell make is the manner in which they articulate the difference between the traditional scientific method with its focus on the replication of results, and action research with its acknowledgement that, quoting from Keynes, social science is not dealing with phenomena that are "homogeneous through time". That is, in social science we are dealing with *open* systems.

Checkland and Holwell (1997) make this same point in their reference to the need for action researchers to increase their appreciation for a "declared epistemology and hence a recoverable research process" and make this explicit by defining action research as a process involving a framework (F) of ideas from which a methodology (M) is derived, and applied to an area of action (A). This FMA framework provides a useful approach to undertaking Argyris and Schon's "double loop learning".

The Tavistock Approach- Emery's ecological learning model.

In an attempt to overcome a range of (closed system) issues associated with socio-technical systems theory and practice, Emery and Trist led the development of the field of social ecology, (Trist et al, 1993). The extant version of this is described by Merrelyn Emery as the "ecological learning model" (Emery, 1999).

Emery (1999: 54) points out that while approaches to learning such as those outlined above address questions such as "are we doing the right things right?" and is "rightness buttressed by power?" and espouse emancipatory practice, they do not adequately address the question of "learning from the environment". They are essentially assuming a closed system framework as distinct from the "ecological learning" approach that originates from contextualism and sits at the centre of the Emery Open System Model. This approach is best represented by Emery's open systems model (Emery, 1999; 2000), described in Figures 1 and 2.

There are two key aspects of this model that make it distinctive: it introduces a "causal texture" of relations in the system environment (L22); secondly, it emphasizes that the agents operating in the system can influence this environment (L12). This model is very much about the real time, coevolution of the system and its environment. The relationships L11, L12, L21, L22 capture the dynamics of this coevolution.

Throughout, participants use their perceptions and experience as the data on which they build their futures. In data collection, participants collectively contribute changes they have seen. There is no other source other than their perceptions and experience on which to judge the significance of their changes. The ground rule is that 'all perceptions are valid'. This has multiple effects, not the least of which is that people begin to restore their confidence in the value of their perceptions. It also has the effect of preventing those with more formal status from devaluing the perceptions of those with less status. (Emery, 1999: 69).

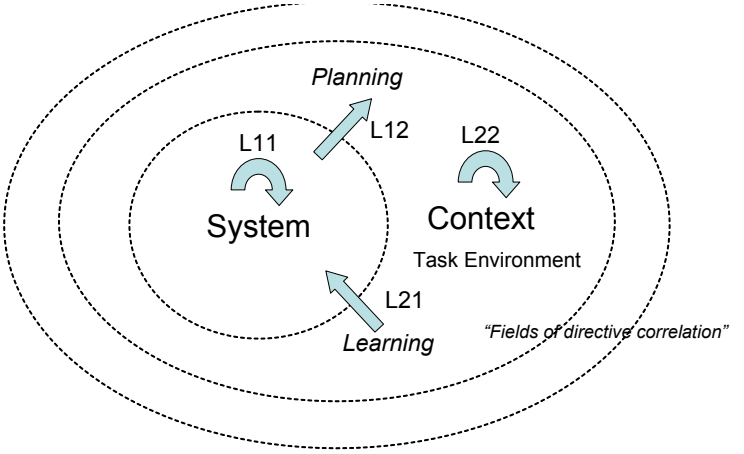

Figure 1 *Emery's Open Systems Model- A Static View (Emery, 1999)*

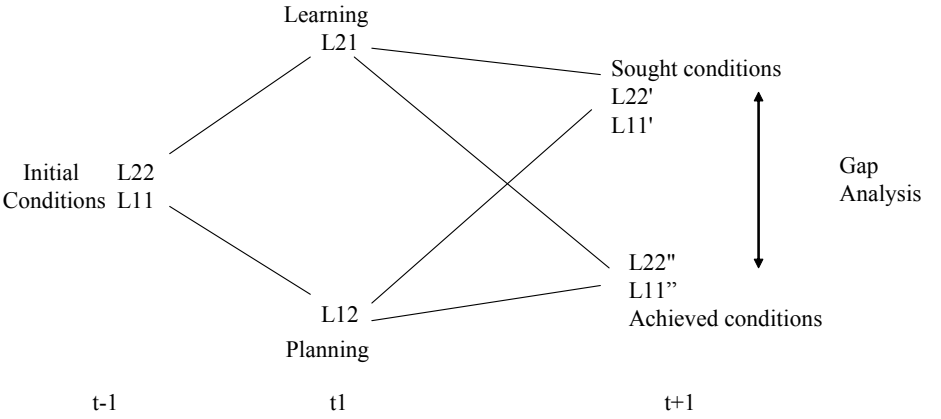

Figure 2 *Emery's Open Systems Model- A Dynamic View (Emery, 1999)*

This stage of ecological learning corresponds to the stage of inquiry associated with forming a hypothesis. The process of continuous ecological and experiential learning continues in the action phases provided the organization operates according to "Design Principle 2"; redundancy of functions (Emery, 1999: 105–136). This structure provides an organizational context within which ecological learning can operate.

Reframing the Scientific Method in terms of Open and Closed Systems.

The ecological approach to action research highlights the use of the open-closed systems dichotomy and provides the opportunity to associate positivist science with closed systems thinking, and action research with open systems (Blaikie, 2004: 838). Barton and Haslett (2007) provide details of this proposal. In this approach, the scientific process is interpreted an analysis-synthesis dialectic in which hypotheses are framed in systemic terms, the most primary constructs being open and closed systems.

In logic terms, irrespective of whether or not hypotheses are formed in open or closed systems terms, Peirce identified three modes of inference: abduction (the formation of hypotheses, deduction, and induction.

Peirce's Inferential Logic

In a significant departure from Kant's dichotomous treatment of deduction and induction, and their links to analysis and synthesis, Peirce returned to Greek dialectic involving three modes of inference: deduction, induction, and abduction (i.e., the logic of forming hypotheses).

In contrast to the more rigorous forms of inference (deduction and induction), abduction takes the form of making an observation about an outcome and proposing a cause for that outcome.

In his early period, Peirce used the terms "abduction" and retroduction" interchangeably but later he reserved the term abduction for the formation of hypotheses and retroduction as the process of testing and refining hypotheses and their final selection (Rescher, 1978).

Peirce argued that abduction was the only form of inference that extends knowledge- deduction simply develops logical results from hypotheses, and induction uses data to quantify and test arguments. Abduction is now recognized as an essential part of the scientific method (Houser, 2005) and has a particular significance for management decision-making (Powell, 2002) and the field of artificial intelligence (Josephson and Josephson, 1994). Haack summarizes the importance of abduction:

"*The method of science requires abduction. Scientific inquiry is creative; it requires imagination to come up with abductive hypotheses. But there are 'trillions and trillions of hypotheses' that might be made, of which only one is true; we succeed as well as we do, Peirce suggests, because evolution has given human beings an instinct for guessing which 'though it goes wrong oftener than right, yet the relative frequency with which it is right is … the most wonderful thing in our constitution'*" Haack, 2006: 25.

Peirce uses these three modes of inference to define a "logic of inquiry". Abduction, deduction, and induction provide a cycle of inference in which experience is used to develop a small set of hypotheses from what may arguably be an infinite set of possibilities; deduction can be used to reformulate hypotheses into forms suitable for testing using inductive inference. This gives rise to Peirce's experimentalism as the pragmatic basis for inquiry and the background to Dewey's instrumentalism. This process supports the analysis-synthesis dialectic described by Barton and Haslett (2007) and forms the logical basis to both action research and positivist science.

As noted above, Peirce's form of inquiry forms the basis of Dewey's experiential learning model (Dewey, 1910) and its extant versions including, for example, Kolb (1984), Shewhart (1939) and Deming (1950), and Argyris et al's (1985) "Action Science".

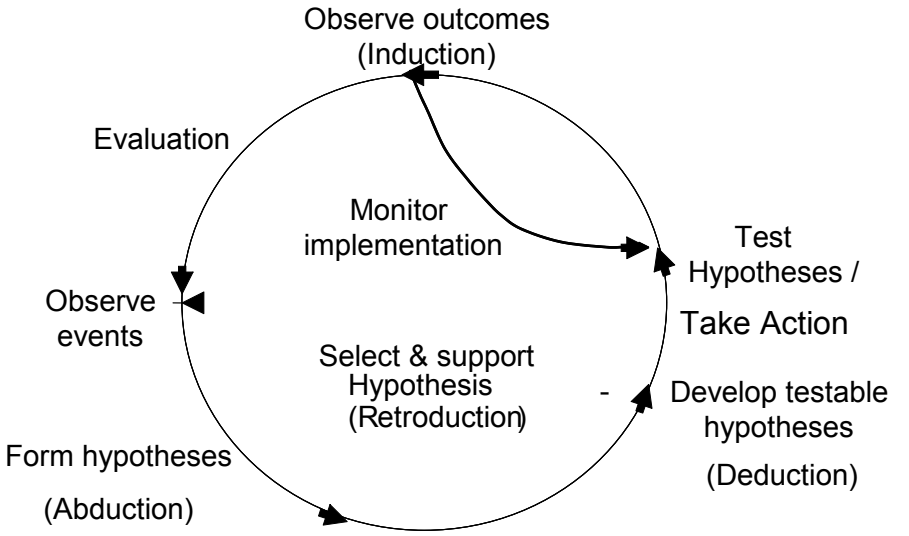

Figure 3 *Peirce's Inquiry Process*

Reason & Bradbury	**Peirce**
Improve the human condition	Resolution of doubt
Practical outcome	Pragmatic maxim
New forms of understanding through reflection & experience	Three modes of inference
Participative processes	Community of inquiry

Table 1 *Comparison of Reason & Bradbury's View of AR with Peirce.*

Despite the emphasis on rigour, Peirce was aware that this process was subject to error (fallibilism) and that all inferences were conditional. On this basis, we can differentiate between the logics of laboratory sciences and social science methods. In a laboratory science, and within reasonable limits, the conditionals (such as room temperature) can be identified, measured, and controlled. In systems terms, a "closed" system is created. In the social sciences, this is rarely possible: we are dealing with "open systems" in which not all conditionals are knowable, let alone controllable. In this sense, laboratory science is a "special case" of social science! To minimise the problems of fallibilism, and to facilitate the multiple perspectives advocated by Lewin, team processes are essential to the inquiry process and correspond to what Peirce termed "communities of inquiry".

It may not be surprising to note that, although dealing at a high level of aggregation, there is a correspondence between the key characteristics of action research described by Reason and Bradbury, and the modes of scientific inquiry proposed by Peirce; see Table.1.

Does Action Research Constitute "Rigorous" Science?

We now want to complete this path of increasing rigour by integrating the threads of this received thinking in action research into the model of science described by Barton and Haslett (2007). Dewey's experiential learning cycles and its popularization in more recent times through the work of Kolb (1984) and others, and its adoption in quality management via Shewhart and Deming (1982, p. 88) helps us establish this link. They are articulations of the analytic-synthetic dialectic and this, together with Peirce's triadic logic of inquiry, provides a rigorous basis to action research.

However, when we pose the question about action research and rigour, we are framing it in terms of the received position of positivist science. When posed in these terms, it is not surprising that, as Susman and Evered (1978) conclude, action research in its various guises, does not constitute "rigorous" science. Checkland's response is that action research attempts to replicate *processes*, and we might suggest that the learning structures described by Argyris, Emery, Checkland and Holwell, Kolb and others represent particular cases of a "covering law" defined by Peirce's system of inquiry.

As Susman and Evered point out, and as has been mentioned previously, there are many deficiencies in positivist science. Social science and management in particular, is about action in open systems. Whether we are talking about positivist science, or action research, action is taken on the basis of a hypothesis that is always going to be conditional on circumstances relating to the system of knowledge of which the hypothesis is part. As discussed above, in the closed systems world of positivist science, we make the presumption that these conditionals are both known and controllable. In open systems, neither assumption is true. So we act on the basis of our best explanation- a decision which is value driven.

The critical quest that we face with positivist science is that it only confirms hypotheses under strict conditions. What happens when we act on these hypotheses in the context of an open system? In the example cited earlier, what happens when a drug that has been extensively trialled under laboratory conditions is released into the open community? Do the hypotheses established by

Property	**Positivist Science**	**Action Research**
Systems frame	Closed	Open
Repeatability	Experimental result	Process
Conditionals on hypotheses	Known and controllable	Unknown and not controllable
Objectivity	Apparent independence of researcher but dependent on the norms of peers	Triple loop learning evaluation; dependent on values of the community of inquiry
Dominant mode of inference	Deduction	Abduction
Action based	No	Yes

Table 2. A Comparison of Action Research and Positivist Research

positivist research still hold? We never know, until we try! That is, we are acting on the basis of our hypothesis to the best explanation and have transitioned from a positivist research domain to an action research domain. In this sense the positivist research has simply been part of what Peirce process of "retroduction". On the basis of the above, Table 2 provides a comparison between positivist research and action research.

Conclusions

In summary, we have argued that action research and positivist science play complementary roles in the broader scope of the scientific method in which hypotheses are proposed, tested, and acted upon and that the logic underlying this process can be explained by reference to framing hypotheses in open and closed system contexts.

From the perspective of action research, Lewin's process has been made increasingly rigorous through a number of refinements and innovations. The problem of objectivity is addressed by Argyris and Schon's concept of single and double loop learning, which involves open reflection of processes. This process has itself been extended in two ways: by Flood and Romm's triple loop learning, and by Checkland and Howell's use of the FMA structure and its usefulness in guiding the double loop learning phase. However, as Fred and Merrelyn Emery argue, these approaches fail to sufficiently emphasise the importance of the environment. Instead, Fred and Merrelyn Emery provide an action learning approach rooted in theories of perception and "ecological learning" which help define the dynamics implicit in Lewin's model. In turn, the ecological approach is grounded in Pepper's (1942) world view of contextualism and with its basis in Peirce's triadic logic of inquiry.

Scientific research and action research are not competing approaches to science, but complementary, albeit as Blum points out, where the design of the scientific method ideally needs to be influenced by the social objectives of the research.

The need for practical outcomes, place action research within a social context where interaction between the environment of the "experiment" and the experiment itself interact and in which values place a critical role. Inevitably, this includes interactions between researcher and subjects, and context and draws on four fundamental premises that are associated with pragmatist philosophy:

1. Peirce's tenet that all human concepts are defined by their consequences;
2. James' tenet that truth is embodied in practical outcomes;
3. Dewey's logic of controlled inquiry, in which rational thought is interspersed with action;
4. Mead's tenet that human action is conceptualized socially and human conceptualization is also a social reflection.

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