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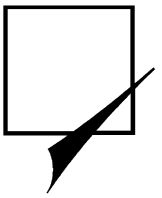

Abduction: A Logical Criterion For Programme and Project Evaluation

MIRI LEVIN-ROZALIS
Ben-Gurion University, Israel

Evaluation is afflicted by a number of ethical and methodological problems. A major problem is the difficulty evaluation has in maintaining itself as an independent, autonomous discipline. An answer to these problems is often sought by recourse to the more structured field of research, even though the canonical logic of research and its criteria are not suitable for most work in which evaluation as a discipline is required.

A possible solution for this dilemma can be found in the work of the American philosopher Charles Sanders Peirce. According to Peirce, the decision to adopt a new hypothesis by a scientist, researcher or, for our purposes, evaluator is as logical a process as deduction or induction. Peirce calls this process 'abduction'.

The evaluator, much like the scientist working through a process of discovery, raises hypotheses that stem from the field being evaluated. By adopting Peirce's methods we can build a logical methodological framework for the process of evaluation. Such a methodology can then provide criteria similar to those used for research, but without losing the unique approach provided by the discipline of evaluation.

KEYWORDS: deduction; evaluation hypotheses; induction; retroduction; validity

Introduction

One of the main problems that programme evaluation as a discipline[1] has to cope with, is the lack of accepted and tested criteria for quality. These criteria are not the same as those accepted for research. In this article I put forward a possible solution to this problem, following Charles Sanders Peirce. Charles Sanders Peirce (1839–1914), an American philosopher and founder of the Pragmatic school of philosophy, suggested a scientific approach that utilizes an original logical category that provides criteria for scientific discoveries, as differentiated from the criteria of proof. He calls this logical category 'abduction'. Abduction is a third logic of scientific enquiry, in addition to the two familiar logical methods, induction and deduction. I propose to show that it is possible to draw a parallel between the process of discovery in science, and the process of evaluating programmes and projects.

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Evaluation as a discipline developed because research did not have satisfactory answers to the type of questions which evaluation deals with. A subject for research must express a relationship between variables, must be formulated clearly and must be subject to empirical verification (Kerlinger, 1972). Evaluation, since it deals with a concrete project, must treat its specific variables as one-time phenomena only, specific to the given project (non-experimental data) (Chen and Rossi, 1992; Nagarajan and Vanheukelen, 1997; Patton, 1981; Rossi et al., 1999). A large number of the questions in evaluation cannot be clearly formulated in advance, since they appear as questions only after the evaluation has begun. Since evaluation must be relevant to the parties involved in the project, the findings are dependent on the particular context in which the evaluation is carried out. Generalization is not always possible. The findings must be formulated in the language and terminology used by the interveners, and they must work according to the timetable of the project, not the timetable of research. The population evaluated, the field in which the evaluation is done, the variables of the project and its phenomena are all givens and not subject to the evaluators' choice *(*Levin-Rozalis, 1998; Nagarajan and Vanheukelen, 1997; Rossi et al., 1999).

The process of research is essentially a process of *praxis*. Science tries to give an inclusive and generalized explanation of a whole area of reality (Peres and Yatziv, 1994) in which the scientific theory[2] serves as a stimulus to action. The formulation of a scientific theory or the refinement of an existing theory is the aim of the whole process of research, be it deductive, inductive, quantitative or qualitative. Theory is the instrument by means of which a whole body of scientific knowledge is collected, changed and explained. Theory organizes constructs, generalizations, definitions and propositions, that demonstrate a systematic view or presentation of a phenomenon by specifying the relations between variables, in order to explain and predict its manifestations (Bechler, 1987; Caws, 1965; Copi, 1961; Hempel, 1965; Popper, 1959; Turner, 1986; Wallace, 1969). If the process of research is *praxis*, then the process of evaluation of plans and projects is essentially based in practice – in examining a concrete entity in order to produce feedback for a variety of interested parties. The process of evaluation emerges from a given field and returns to it. Stakeholders in projects or project planners usually have a theory, either a declared one or one that has to be discovered and articulated. These theories are themselves an object of evaluation (Rossi et al., 1999).

Scriven effectively describes the double bind in which the evaluators find themselves, because on the one hand they are unable to start from a theory and on the other are limited by the lack of a theory. Nowadays there is a well-based discipline of evaluation and a fairly good practice of evaluation, but there is no theoretical underpinning to provide a generalized frame of reference for evaluation (Scriven, 1996). Various authors discuss the near impossibility of such a structure (Patton, 1981; Pawson and Tilley, 1997; Levin-Rozalis, 1998).

Evaluation as a practice has additional criteria that distinguish it from conventional research. Its basic function is to give feedback to interested parties, whereas the main function of research is to enlarge the body of scientific

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knowledge. Research aims to formulate a general law and emphasizes internal and external validity, while evaluation stresses internal validity and explanations of causation.

All this has created a situation in which the lines of development of the practice of evaluation as a discipline have distanced it from conventional research and from the accepted criteria for determining its quality (Levin-Rozalis, 1998; Nevo, 1989; Nagarajan and Vanheukelen, 1997; Rossi et al., 1999; Scriven, 1996; Pawson and Tilley, 1997; Patton, 1981).

Since Tyler related to evaluation as a field distinguished from research (Tyler, 1942), the demands on the evaluator have increased and the criteria for judging his/her work have weakened. We can observe two central changes.

The first change is the retreat from the concept that deductive propositions that underlie the aims of the project determine the questions and the methods of evaluation. Instead, the questions, and the methods that develop from them, arise from the field being evaluated. This process evokes a turn towards questions and methods of evaluation that are simultaneously adapted to the specific situation.

The second change is that the focus of evaluation has moved, from the results of the evaluation themselves to the question of for whom, or for what, the information collected is important, and how this information will be utilized. This affects the kind of information to be collected (Rossi and Freeman, 1982; Rossi and Wright, 1984; Smith, 1986).

In addition there is a need to supply useful information to help in deciding between alternatives, to give decision makers a basis for informed decisions and to improve purposeful action for advancing processes and services. Evaluation is expected to be a tool for designing programmes, scrutinizing aims and checking plans of action, means of operation and results of intervention. It is expected to assist in bridging between cultures, in reconstructing concepts and, indeed, the *weltanschauung* of its clients, and in empowering clients (Nevo, 1989; Abma, 1997; Drewett, 1997; Guba and Lincoln, 1989; Pawson, 1996; Renzulli, 1975; Rossi et al., 1999; Scriven, 1967; Stufflebeam et al., 1974).

Patton lists the requirements demanded of an evaluator. An evaluator must be:

> technically competent, politically neutral, politically sophisticated, politically connected, ethically pure, consumer-oriented, cost conscious, professional, independent, epistemologically grounded, honest . . . and flexible. [Evaluators should] . . . follow the biblical mandate to 'go forth, be fruitful and multiply', multiple methods, multiple audiences . . ., multiple funding sources . . ., multiple perspectives . . ., multiple paradigms . . ., multiple terms for evaluation . . .' etc. (Patton, 1981: 11– 2)

Patton also adds an implied demand – the evaluator must also be creative.

All these changes have resulted in a lack of clarity in methods of evaluation. The changes have come at the expense of the clear and accepted systems of research. Currently, it is the evaluator who determines what kind of information is important and to whom it is relevant; how to collect the information; how to process it; what conclusions are to be drawn from it; and what recommendations should be made. Methods and models of evaluation have been sought that would replace the clear and accepted methods of research and provide a framework for

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evaluation that would not leave everything up to the personal judgement of the evaluator (Alkin, 1968; Dillon, 1981; Provus, 1971; Renzulli, 1975; Scriven, 1972; Stake, 1969; Stufflebeam, 1983). Most of these models cannot be transferred to new programmes and projects, cannot easily be implemented and have not become an efficient and accepted framework for evaluators. In addition, a majority of evaluators attempt to employ mechanical, experimental formats.

It is claimed that in a method-oriented evaluation, many questions are ignored because they are not a part of the methodological design (Chen and Rossi, 1983; Chen, 1990; Finney and Moos, 1992; Pawson and Tilley, 1997). But most approaches to evaluation try to formulate understandings and explanations which are broader than mere numbers and relate to the larger picture of the project's context and surroundings. This is the case, for example, in 'realist evaluation' (Julnes and Mark, 1998; Mark et al., 1998; Pawson and Tilley, 1997); in 'theory driven evaluation' (Chen and Rossi, 1983; Chen, 1990); or with the constructivist approach (Guba and Lincoln, 1989).

Because of these problems, evaluators find themselves positioned between the hammer and the anvil. On the one hand, there is the demand to give different answers to many questions, and on the other hand, there is the lack of a clear framework or efficient means to deal with complex and changing circumstances (Eyken et al., 1995; Finne et al., 1995; Guba and Lincoln, 1989; Kazi, 1996; Nagarajan and Vanheukelen, 1997; Pawson and Tilley, 1997; Scriven, 1996; Stake, 1998; Tucker and Dempsey, 1991).

The solution that Patton offers – 'be creative'– is important, but when creativity forms the most significant part of what the evaluator has to offer, evaluation becomes an 'artistic endeavour' rather than an academic discipline. It forfeits its standing as a serious subject and its ability to exert influence, and leaves the evaluator open to political and other kinds of pressure. The process of evaluation becomes a focus for criticism and disagreements and the work of the evaluator is impeded, both within the field and outside it (Scriven, 1996).

Science and the Process of Discovery

In my opinion, it is possible to find a solution for these problems in the work of the American philosopher Charles Sanders Peirce, founder of the Pragmatic school of thought, who claimed that the process of scientific discovery is subject to logical categories which he proposed should be utilized.

Peirce's arguments are important because he creates a new logical category and a new kind of reasoning that he calls 'abduction', and because these categories can be adapted to the field of evaluation:

> Abduction is a process of drawing conclusions that includes *preferring* one hypothesis over others which can explain the facts, when *there is no basis in previous knowledge* that could justify this preference or any *checking* done *after* the hypothesis *was subjected to a trial period*. (Peirce, 1955b: 151, my emphasis)

It is important to notice that the hypothesis that Peirce mentions does not arise

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from any theory, but from the facts. That is to say that in encountering any situation, at the stage where we do not have enough satisfactory evidence about the facts and we have not yet carried out any examinations that might support this hypothesis, we nevertheless prefer it. We do so at a stage where our only criterion is the standing that the hypothesis has according to the laws of logic.

Richard Fox defines the use of the process of abduction:

> Abduction is inference to the best explanation. It is a form of problem solving used in a diverse number of problems, from diagnosis to story understanding, to theory formation and evaluation, to legal reasoning, to, possibly, perception. (Fox, 1998: 1)

The philosophy of science, and the scientific world in its wake, has considered the area of scientific discovery, or the establishing of hypotheses from facts, to be 'uninteresting' variables which belong to personal psychology, social conditions, the knowledge and thought processes of a particular age, and as such are entirely beyond the scope of logical processes. Why Darwin formulated the theory of evolution in the light of his startling findings in nature, or why the falling apple incited Newton to formulate the laws of gravity, are seen as questions of interest only to historians and storytellers. The theories of evolution and gravitation, and many other theories, became interesting to the philosophy of science and the scientific community only after they were formulated and the processes of validation or rejection had begun.

Peirce, following Aristotle, disputes this concept and argues that the suggestion of a hypothesis for scrutiny, or an *ad hoc* explanation for a new or surprising phenomenon, is a logical process. This means that a hypothesis, or a discovery, must observe the laws and conditions of logic for us to start examining it. Is event A a good reason to pose hypothesis H1? Do the findings in Galapagos and other places justify proposing the theory of evolution? These are purely logical questions. Peirce claims that we must, in the first place, distinguish between the logic of discovery and the logic of proof.

In *The Logic of Discovery*, where he refers to abduction, Peirce explains the positing of a hypothesis in light of a possible explanation of facts that have no previous explanation:

- Surprising fact C is observed:
- But if A were true, C would be a matter of course,
- Hence there is reason to suspect that A is true. (Peirce, 1955a)

Peirce claims that hypotheses or discoveries in themselves do not constitute a theory. Only observation can create and ground theories. Therefore, we must speak of two separate processes. The reasons for accepting a specific hypothesis (to confirm the theory of evolution or to confirm the claim that the planetary orbits are elliptical and not round) are not the same as the reasons for suggesting this hypothesis (the process of the discovery). Our reasons for accepting a hypothesis are the reasons that make the hypothesis true, while our reasons for suggesting the hypothesis in the first place are those that make the hypothesis conceivable (Hanson, 1958; Fann, 1970). The question that arises from this is whether there can be a logical 'process of discovery'. This concept would seem to

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have an internal contradiction. Are we perhaps discussing a process that is essentially psychological?

To this point Peirce responds that psychology deals with the question of how we think. This question is not relevant to logic or science, and it also has no bearing on the process of affirming a hypothesis. Logic deals with the question of how we should think. By this Peirce means the process of reasoning in suggesting and choosing hypotheses. A hypothesis may have psychological sources but this would not explain its choice. Choice is a rational process and must adhere to logical criteria (Burks, 1946; Fann, 1970; Rescher, 1978).

Reasoning must have a criterion indicating quality, some indication of what good reasoning is. Reasoning incorporates some conscious acceptance of a reason, and conscious acceptance of a reason cannot exist without comparing the suggestion with some concept of what it should look like. The question is whether the conclusion reached by applying some statement (hypothesis of discovery) is congruent with the facts or not (Burks, 1946; Peirce, 1955a; Rescher, 1978), and that is the criterion for the quality of the reasoning.

It is possible that all our scientific knowledge rests on observed facts, as Peirce argues. However, facts are always the object of our interpretation. The process that precedes every purposeful action takes place in our minds. We must identify an inkwell as such and know its characteristics, before we can observe it meaningfully. But only when our conscious cognition begins to create propositions or judgements on some fact can we begin with any sort of review of the process of reasoning. All the preliminary process is not under our control, and is therefore not subject to our judgement in logical terms. But the conscious part of the process can and must abide by the criteria of logic.

Peirce claims that things have an internal structure of meaning. The abductive activity is not empirical (not based on experiments or examination by human senses), but on the internal structure of the meaning itself (Rosental, 1993). Knowledge, Peirce claims, is a process of accumulation, rather than revolution. This is what enables us to form explanations or hypotheses about a new or surprising phenomenon.

Peirce thought that absolute 'truth' existed somewhere 'out there', but when disconnected from our senses and the meanings we give to phenomena, it was essentially meaningless. The meaning that we give to phenomena helps us to choose one hypothesis out of an infinite number of possible hypotheses as a solution to a specific problem. The behaviourist explanation of trial and error cannot serve us in this case, according to Peirce, because the process would never be finished.

Since scientific knowledge is cumulative, and is gathered by the observations made by people who have both knowledge and opinions (Tursman, 1987; Yu, 1994), hypotheses are made because they resemble previous hypotheses or knowledge, because they are connected to a universe of relevant content, because they resemble other phenomena in the area being researched, or because it is possible to see analogies between them and other phenomena for which explanations have been formulated theoretically. The criteria for forming hypotheses are the same as those for functional logic, *logica utens* (Burks, 1946). That is to say, we are dealing with an intellectual process in which a new hypothesis is chosen out of an

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infinite number of possible hypotheses to be tested – i.e. to be confirmed or rejected. The hypothesis is subjected to various logical tests such as similarity, symmetry, analogy and authority. This is the stage of abduction in which the hypothesis is formulated, chosen and explained.

According to Peirce, an investigation that serves only to verify a hypothesis after it has been formulated involves leaving a large part of the process of research hidden and unexamined. Peirce claims that the observation of facts is intimately connected to the situations in which the facts are observed. Thus, the facts do not include practical knowledge about future situations. It is necessary to add interpretations to the facts, or assumptions about possible interpretations or about possible future behaviour. The process of adding propositions to observed facts, in order to adapt them to situations that are different from those in which they have been observed, can be termed a hypothesis. This process of forming a hypothesis can and must be examined. In addition, the hypothesis must stand up, in principle at least, to an empirical scrutiny (Peirce, 1955b; Rescher, 1978).

Charles Sanders Peirce had his own theory of the progress of science and of scientific logic. In his opinion, both research logics, deductive logic and inductive logic, fail when applied to innovations or to breakthroughs in science. Deductive logic fails because it is not meant to deal with new phenomena. Inductive logic fails because we are dealing with phenomena whose variance is known.

The deductive hypothesis analyses the grounds of a theory after it has been formulated, in a process of derivation from theoretical generalizations to particular hypotheses. The hypotheses are bound by a logical tie that is valid for its antecedents, that is to say, for previous theoretical assumptions. The deductive process of deriving assumptions is structured in a way that makes the hypothesis 'the thing explained' *(the explanandum)* of the deductive statement. Thus there is nothing novel in the hypothesis – indeed novelty is forbidden – for the explainer *(the explanans)* is an *a priori* theoretical assumption. When a law reaches the status of a deductive hypothesis, the original, creative, scientific thought is finished. The deductive hypothesis starts out from the theory as a given and must, of necessity, decrease from the more abstract level to hypotheses which are more concrete in nature. This process obscures the original connection between facts and laws, a connection created by the reverse process of generalization. Thus, deductive conclusions, for all their value, can never increase our real knowledge, can never innovate beyond what existed previously. This system of making assumptions is good for research that aims at reviewing theories with a view to refining them (Copi, 1961; Fann, 1970; Hanson, 1958; Peirce, 1931–5: 2.860; Rescher, 1978; Turner, 1986; Wallace, 1969).

Inductive logic, according to Peirce, also fails when it tries to innovate because by its nature it deals with phenomena whose characteristics are known. Induction is where we generalize from a number of cases of which something is true, and infer that the same is true of a whole class (Peirce, 1931–5: 2.624). The generalization is from a sample to all phenomena of the same kind. The process attempts to check the probability that these known phenomena will repeat themselves beyond the limits of time and space, and in this way formulates a law of general probability (Davis, 1972; Hanson, 1958, 1960; Rescher, 1978). In order to know

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its probability we must identify the characteristic being checked and the *a priori* conditions (e.g. that a coin has two sides and it must fall on one of them) (Copi, 1961).

Inductive logic does not help us to formulate laws, it merely checks the probability of hypotheses. In order for a hypothesis to become a law it must be a proposition that explains its examples. If we see that a general proposition supplies only immediate concrete knowledge of the truth of its examples, it cannot explain them (Braithwaite, 1934). The reason for the apple falling down from the tree is not explained by the fact that all apples fall down from trees. The explanation does not speak of 'falling' or of 'down'. It uses the terms 'attraction', 'gravitation' and 'mass'. It does not use the terms of the observation; it supplies new concepts of its own.

Induction is a constantly self-revising process with varying levels of probability of prediction. Thus, even previous to its explanation, the same fact that was predicted in an inductive process (all apples fall from trees) does not serve to support a hypothesis, or even to suggest its probability, but rather indicates the process by which the prediction was made, and its being a chance sample of all the predictions that might be based on this same hypothesis. This is what creates the practical area of verification – at least until new facts appear, which might change the level of probability (Braithwaite, 1934).

Since induction cannot innovate and merely checks known assumptions, it has an important role in checking hypotheses that arise in the process of discovery. Deduction is a process of checking theories; induction is a process of checking hypotheses; and abduction is a method for their discovery. The distinction that Peirce makes between induction and deduction on the one hand, and abduction on the other hand, is linked to the distinction between the theoretical and the explanatory aspect of science. Induction draws conclusions from samples and sampling and applies them to the whole, while abduction draws conclusions from a body of facts to an explanatory hypothesis. In 'conclusions', Peirce includes the methodology of the process as well as the process of proof.

Peirce distinguishes between a proposition or a hypothesis, and a claim or assumption. A proposition must be supported or disproved, while an assumption is definite. Abductive explanations for what Peirce calls 'surprising facts' (Peirce, 1995b) are propositions. They are hypotheses on probation (Fann, 1970; Yu, 1994). This makes clear the most important characteristic of abductive hypotheses and how they differ from deductive hypotheses. Conclusions drawn in an abductive process usually show a new idea, whereas deductive conclusions generally stem from their predecessors, continuing them forward (Takeda and Nishida, 1994).

Abduction and Evaluation

When speaking of the social sciences in general, including the practice of programme and project evaluation, Peirce's concepts are even more relevant. In comparison to the exact sciences, social phenomena are extremely complex. They are complex for a number of reasons:

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1. They have less of a tendency to repeat themselves.
2. They are not so open to direct observation.
3. Their variability is much greater, since they are less uniform.
4. It is more difficult to isolate a phenomenon.

From all the above we can see the difficulty in creating instruments for reliable observations. A thermometer is a thermometer, but a questionnaire in one population is not necessarily the identical questionnaire in a different population, despite the fact that we tend to assume this.

When, as often happens in the field of social studies, the number of possible reasons for a phenomenon is very large, or, as occurs in many cases, we are not able to isolate a particular factor, it is extremely difficult to eliminate hypotheses. A social situation is a fabric in which it is very difficult to change one or other factor without affecting, in some measure, all the others.

When the number of cases is very large, it is possible to posit a certain known variance. But when we are dealing with smaller numbers this is no longer a valid possibility. Thus we cannot use the accepted mathematical systems of the natural sciences. As a result, research in the social sciences deals with generalized facts and abstract concepts to formulate laws. Social science research finds it difficult to deal with the actual phenomena, with a 'here and now' complexity. Laws, although generalized and concrete, declare what would be correct if all the other factors were givens, or neutralized. This is what happens in physics. In the social sciences this happens only in theory (Cohen, 1953; Turner, 1986).

In the process of evaluation, whose aims are different from those of research, no attempt is made to formulate a law or a theory, but attempts are made to give effective explanations for diverse phenomena in the field being evaluated. The task of evaluation, as we have already pointed out, is field-dependent, in the sense that the field being evaluated dictates the questions, the variables, the population, the terminology (in part), the timetable and the possible instruments of research. Evaluation does not deal with generalized and abstract variables, but with the immediate and specific facts. And facts need explanations that will organize them into a sensible structure – some kind of theoretical frame (Turner, 1986; Chen and Rossi, 1992).

Deductive logic and inductive logic run contrary to the logic of evaluation. In the process of evaluation we proceed most of the time towards the hypothesis and not from it. Even when the evaluee stems from a theory, there are so many unpredictable factors in the field, so many interfering variables, so many influences, that the amount of surprising facts is most of the time large, and so, therefore, is the need for abduction and retroduction. That is why many hypotheses stem from facts discovered in the field in order to explain them (Levin-Rozalis, 1998). Deductive logic and inductive logic stand up to logical criteria and are acceptable in a conventional process of research. For the 'process of discovery' and for evaluation, there are no accepted logical criteria, which leaves them both outside the agreed definition of 'research'. Abductive research logic can be suitable in situations where both deduction and induction fail us. Moreover, the yardstick

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that Peirce formulated as an abductive process can fill a vacuum: the total lack of universal criteria or measuring instruments for evaluation.

The research logic of abduction can easily be applied to the process of programme/project evaluation and to the analysis of the data that are gathered in such a process. The evaluator is inside a field of facts that he is examining. He sees phenomena, he sees events, but he cannot yet explain their significance or importance. He posits assumptions. He raises questions for examination. These assumptions and questions arise from the field being evaluated, not from phenomena with known variability, and not from any theory.

The process that Darwin went through, for example, from discovering the facts of the different development of creatures in different environments, up to the stage of formulating the theory of evolution, is analogous to the process that an evaluator goes through when he uncovers various facts in the field being evaluated and tries to give some explanation for them. True, the explanations of the evaluator are linked, at least in the early stages, to the 'here and now' of the field, and are not yet a general theory. However, if we accept Peirce's concept, they must stand up to scrutiny and adapt themselves to logical criteria, just as if they were to be formulated as a general law from observed facts in any other process of research.

Since this is so, we can now argue that the process of evaluation is, for the most part, immersed in a 'process of discovery'. Evaluation, like the 'process of discovery' in any scientific research, goes through a stage in which there are no yardsticks, in which, as yet, no criteria have been formulated for making judgements. In evaluation, as in any scientific research, examining the path to a hypothesis is legitimate and no less important than examining the path that any researcher takes from a hypothesis in a deductive process.

Evaluation stands up to the criteria that Peirce established for a logical process, since it is not an impetuous or an accidental process but rather an intellectual process that is strengthened by two stages of logic. After we have observed facts that are new to us we do not try all possible explanations. We adopt only those that are the most probable and seem right to us.

Putting forward explanations of findings in the practice of evaluation is actually formulating a hypothesis, what Peirce calls 'a hypothesis on probation', because it has not yet been supported or confirmed in any way. However, as Peirce argues, the hypothesis must, at this stage, stand up to double logical criteria. First of all, it must meet the criteria that permit it to be posited in the first place – abduction – the criteria of functional logic – *logica utens* (Burks, 1946), which is essentially critical thinking. Second, it must meet the criteria of being a fitting explanation – retroduction – which is an intelligent examination, conforming to the laws of logic – *logica docens*, a systematic study of the process of reasoning.

After a hypothesis is chosen by the use of *logica utens*, it is necessary to examine its quality and efficacy. Retroduction is the process of examining the hypotheses on probation and testing their ability to stand up to logical criteria and to fit the data, either to eliminate them or to build an empirical generalization (Rescher, 1978). Here, according to Peirce, we must use the accepted criteria for checking

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the validity of the hypothesis. By this he means the same criteria we use to examine a hypothesis by a process of deductive derivation – *modus tollens*, hypothetical syllogism, disjunctive propositions, syllogism etc. The rules of deduction are meant to explain the relationship between the premises and the conclusions of a valid argument, and to supply a technique for the evaluation of a deductive argument. However, in terms of abduction, this technique is used to examine the logical structure relating to the facts, that is to say, the process is inverted. We go from the observed facts to generalization and not from the theory to the particular instances, which is why it is referred to as 'retroduction' (Peirce, 1955a).

Facts A, B and C are observed; hypothesis Y seems best able to explain all these facts: there is a reason to use Y as an explanatory hypothesis. This structure converts into a structure similar to a deductive structure – i.e. retroduction. In this process the explanatory hypothesis Y becomes an *explanans* – and the facts take the role of conclusions (the *explanandum*) – as if they were derived from it. Deductive reasoning is *a priori*, inferring an effect from its cause. Abductive reasoning is *a posteriori*, inferring a cause from its effect. In this way a structure of explanatory hypothesis is determined as being subject to logical criteria, just as in the process of deductive logic that is used for refining, supporting or disproving scientific theories.

In the process of evaluation, the explanation is often a hypothesis. The hypothesis has to explain the facts, in the sense that it then makes it possible to derive the facts logically from the explanation. This conforming to the logical criteria of retroduction links the explanation back to the facts, since this is the essence of retroduction, as distinguished from induction and deduction, that work with abstract and generalized concepts. That is to say that the explanation, in itself, has no value without the facts from which it stems. Peirce[3] would surely have agreed with Darwin who claimed (as cited by Kerlinger) that all the observations must support or refute a single fact, if we want to use them (Kerlinger, 1972).

The process that Peirce suggests forces the evaluator to insert and integrate two more strata in his evaluation: a stratum of findings and a stratum of explanations that can lead to theory. In the field of evaluation, we frequently encounter reports that offer us a wealth of findings, beautifully organized with tables and graphs, but without explanations, interpretations or any theoretical framework. On the other hand, we also come across amazingly creative reports that do not show the data supporting the conclusions.

The process of retroduction demands a display of the findings that were collected in the field, an explanation of those findings (which are hypotheses on probation, since they have not yet been checked), and a logical connection between them. The process can be an ongoing process from understanding to deeper understanding and to more complex claims.

An Example from the Field of Evaluation

The director of a large national project for integrating and empowering new immigrants decided to change the structure of the project, and to turn it into a public association. Members of the new immigrant community became the association

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members, and young leaders from among them were elected as the board. The director of the project stayed in his job, but the board and the director did not manage to get along. Both sides were very frustrated. The board members claimed that they were just a rubber stamp for the director's decisions. The director disagreed and blamed the board for being impatient and immature.

A hypothesis was put forward suggesting that the veteran director was making decisions by himself, taking advantage of a board of novices. This would explain the tension. A process of retroduction rejected this hypothesis. Observations made over a very long period of time at board meetings showed the opposite to be true. The director involved the board in the whole of the decision making process, and kept the members of the board updated, providing them with all the information they required during the process.

A second hypothesis was that the board members did not understand their role definition and the division of labour that was supposed to exist between a director and a board. They were young and inexperienced. That could explain their frustration and the director's claim concerning their immaturity. This second hypothesis was also checked. Long, in-depth interviews of board members, and observation of board meetings, showed us that this is not the case. The board members understood their function, and the differences between their role and that of the director.

The process of retroduction examines specific instances of hypotheses on probation. When they do not agree with the findings, they cannot be the explanation. Here we have a surprising fact. This is a simple disjunctive[4] proposition, which can be confirmed by direct observations.

- If A (There is frustration on both sides), then B (There are problems in the relationships).
- If B (There are problems in the relationships), then C (The director manipulates the board members) or D (The board members do not understand their role).
- Not C (The director doesn't manipulate the board), and not D (The board members know their roles), then there must be another reason for the phenomenon.

A phrase from the director during an interview: 'I have to teach them everything', rang the bell, and led us to our hypothesis on probation: the situation created an impossible organizational structure: the director had to teach the board how to manage him. Both the director and the board held two contradictory positions: Board versus Director on one hand; Trainees versus Guide on the other. We offered a solution: the board will take an external advisor, and keep the role relationship between them and the director uncontaminated and straightforward. It worked.

The process of retroduction: two false hypotheses were rejected after a simple process of disjunctive inference. The explanation (e*xplanans*): contradicting roles of both director and board caused misunderstandings and frustration. Further observations confirm this explanation. But more than that, they rejected the false,

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more obvious hypotheses. The process of retroduction strengthened the explanation and added weight to it, above and beyond the impressionistic claim of an evaluator.

This, of course, is an oversimplification for the purposes of giving an example. The conclusions in an evaluation process are frequently much more complex. The example is very intuitive since it is very easy to show the connection between the observations and the conclusions, and the added value of retroduction is not as impressive as one might wish.

A second example: a programme for intervention in the home, which aims to improve children's attainments in kindergarten by providing parents with tools for the cognitive advancement of their children, was run for a group of new immigrants from Ethiopia. The immigrant mothers, who were not familiar with the concepts or the language in which the activity was conducted, exhibited acute frustration while the activity was going on. When these mothers were observed trying to teach the skills to their children, it was seen that the children were familiar with most of the concepts and activities. Worse, the children showed disrespect for their mothers, who did not fully control the language or the materials they were trying to use. Nevertheless, the children included in the programme showed more progress in kindergarten over the year than did the children in a control group.

The rather banal conclusion, that the programme simply worked (it achieved its goals) and transferred the desired skills to the children and that it was these skills that brought about the children's progress, is not confirmed by the observational findings. Observation showed that the children controlled the materials better than their mothers, and that they showed disrespect for their mothers, who were shown up by their inability to control the materials.

The process of retroduction contradicts the conclusion that the programme worked logically, in the form of *modus tollens.*

- If the programme is successful (A), the programme teaches the children new skills (B).
- The programme does not teach the children new skills (Not A).
- The programme does not work (thus not B).

Another possible assumption, that the kindergarten teachers were misled, is not congruent with the findings, since the kindergarten teachers did not know which children were participating in the programme and which not. Here too, retroduction in the form of *modus tollens* refutes the assumption.

Another assumption was that the very fact that their mothers invested time and energy legitimized the inter-cultural jump that was demanded of the children. This assumption is abduction. It stems from the surprising fact that the children progressed but not because of the expected reason. The assumption arises from familiarity with situations demanding inter-cultural jumps, and from knowledge of the importance of legitimization in producing change. The explanation is now a hypothesis on probation and has yet to be checked. The first check is in light of the findings in a retroductive process.

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Hypothesis: children in the programme receive legitimization of an inter-cultural change The legitimization process (A) means delivering a message that certain behaviour is both permissible and desirable (B). This message (B) can be sent if the parent herself behaves in that very way that is both permissible and desirable (C). The parents in the programme behave as they would like their children to behave, insofar as they deal with changing learning styles, despite the difficulty that they encounter (C). Therefore the children receive legitimization to make the inter-cultural change in their ways of learning.

Unless the logical validation is shown to confirm the abductive hypothesis, it would be understood as an interpretation, far from a factual base. Presentation of the facts alone would leave most of the readers with the mistaken impression that the programme achieved the goal it was aiming at from the outset – acquisition of new or missing skills. Only the addition of these two strata can give a complete picture, which is confirmed by the data and validated by logic.

With the completion of this process, weight is added to the evaluator's report. It is no longer an intuitive flight of the evaluator's fancy which must, to paraphrase House, convince rather than determine and be more creative than scientific (House, 1973: 73). These are explanations which have the form of propositions, and which stand up to the test of logic as well as to the facts. This gives it a double strength, on account of the validity of the logic (as in deduction, because of the retroduction) and of the truth values of empirical facts, since the facts are the point of departure. If the explanations of the evaluation are both logical and factual we can accept them as propositions and they are worthy of being included as a rung in a process of research, similar to a process of discovery which has greatly contributed to enlarging the body of scientific knowledge.

All this is true even when the programme has a theory to follow, as shown in the next example. A nationwide programme used psycho-dynamic methods to treat groups of children who were rehabilitating drug addicts. The rationale of the programme stemmed from psycho-dynamic theory, and training for the groups' leaders emphasized psycho-dynamic theory and methods. On examining the children's defence mechanisms, the strength of their egos, their ways of coping with reality, basic trust and so on, enormous progress was evidenced. The obvious conclusion: psycho-dynamic methods are effective in coping with this type of problem. Our observations during group time, and the interviews we conducted with group leaders, however, told us another story. It seemed that most of the group leaders worked using a variety of diverse methods: behaviouristic; humanistic; eclectic and mixed methods; art therapy; and methods of all different sorts and kinds. We could not discover significant differences between children from the different groups, although, according to the criteria of psycho-dynamic theory, they all progressed remarkably well (Bar-On et al., 2000). Here, as in the previous two examples, we faced a surprising fact. The apparently self-evident answer, that psycho-dynamic methods work, was not congruent with our findings. Our hypothesis on probation is that a sane and supportive environment helps children to make sense of their lives, with no bearing on the theory that stands behind the sane framework or the supportive treatment. We could not have reached this conclusion without the process of retroduction, without rejecting the

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obvious hypothesis that was congruent with only part of our observations (the progress that had been made by the children during treatment).Then, having a surprising fact, we looked for a new explanation that was congruent with all our observations.

Conclusions

Adoption of the processes and criteria that Peirce offers us may act to reunite evaluation and research. Evaluation will no longer be seen as a sort of step-sister to research, but as a full partner, a generator and initiator of knowledge similar to the process of discovery. Furthermore, the practice of evaluation deals with knowledge of the sort that social research finds difficult to cope with: concrete, very complex knowledge, tied to the here and now. Peirce makes it possible for us to formulate an explanation, or adopt a theory that fits our findings, without losing touch with the special knowledge characterizing evaluation: knowledge that is tied to the field, to reality and to the world, and not to theoretical and generalized propositions. This knowledge, processed in accordance with the demands of abduction and retroduction, can conform to research criteria, and permit the continuation of inquiry and examination, without losing the uniqueness of evaluation, which allows it to cope successfully with a multitude of variables and phenomena, and unknown variance. Evaluation remains firmly tied to a given concrete reality, on one hand, and to research and theoretical explanation, on the other.

Notes

1. Evaluation evaluates educational, communal and social programmes, as well as educational curricula projects – broad and limited, simple and complex, short-term and long-term. It examines structure, process, relationships and results in respect of individual items and of frameworks as a whole. For convenience and in view of the limitations on the length of this article, all these will be subsumed under the term 'projects'.
2. I am not entering into a discussion of the meaning of concept theory, or an argument about when a string of generalizations may be termed a theory; it is irrelevant here.
3. In Peirce's words: 'An abduction is a method of forming a general prediction' (1931–5: 2.269) but this prediction is always in reference to an observed fact, indeed an abductive conclusion 'is only justified by its explaining an observed fact' (1.89 as it was collected by Feibleman in Feibleman, 1946: 122).
4. The various logical terms can all be found in any textbook dealing with basic logic, such as Copi (1961).

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DR MIRI LEVIN-ROZALIS is a sociologist, and a member of the Department of Education in the Ben-Gurion University of the Negev, Israel. Over the past 20 years she has been an evaluator of programmes and projects in both the social and educational fields. She also teaches programme and project evaluation to graduate students at the University, and is the head of the Unit for Evaluation and Research of the Department of Education. For the last two years she has been a member of the secretariat of IAPE – the Israeli Association for Program Evaluation. Please address correspondence to: Department of Education, Ben-Gurion University, PO Box 653 Beer-Sheva, Israel 84105. [email: rozalis@bgumail.bgu.ac.il]

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