Science as method: the conceptual link between Russell's philosophy and his educational thought

by Howard Woodhouse

THE QUESTION OF the genre of Russell's political, social and educational writings has become a matter of some debate. This is not least because Russell himself suggests that there is a sharp division between his "popular writings" and his "technical philosophy":

> With regard to *Social Reconstruction*, and to some extent with my other popular books, philosophic readers, knowing that I am classified as a "philosopher", are apt to be led astray. I did not write *Social Reconstruction* in my capacity as a "philosopher"; I wrote it as a human being who suffered from the state of the world, wished to find some way of improving it, and was anxious to speak in plain terms to others who had similar feelings. If I had never written technical books, this would be obvious to everybody; and if the book is to be understood, my technical activities must be forgotten.[1]

Russell's selection of *Principles of Social Reconstruction* as a non-philosophical work is surprising because it begins with a declaration that he wishes to advance a political philosophy more capable of standing erect in a time of crisis than traditional liberalism.[2] The inference to be drawn is that Russell uses the term "philosophy" in two different senses[3]: one in which it is strictly defined as the "science of the possible",

[1] "Reply to Criticisms", in Paul Arthur Schilpp, ed., *The Philosophy of Bertrand Russell* (Evanston: Northwestern University, 1944), pp. 730–1.
[2] *Principles of Social Reconstruction* (London: George Allen and Unwin, 1916), p. 9.
[3] See Alan Wood, "Russell's Philosophy: A Study of Its Development", in Bertrand Russell, *My Philosophical Development* (London: George Allen and Unwin, 1959), pp. 276–7.

namely logic and the philosophy of mathematics; the other in which it is more loosely defined to include empirical and conceptual questions arising in epistemology and philosophical psychology and normative questions that arise in ethics, social, political and educational theory. It is in this latter sense that he apparently uses the term in referring to his own political philosophy.

On the basis of the distinction Russell states that his popular writings, which are normative and aimed at improving the lot of mankind, are non-philosophical in the first, technical sense. It is clear that in writing *Principles of Social Reconstruction*, he is not interested in defining such concepts as "impulse" or "the principle of growth" in the precise manner that he would be if his audience were professional philosophers. Rather, he assumes that his lay readership has a general familiarity with the terms. However, it is not clear that this relative imprecision about the concepts under consideration implies that he does not make use of philosophical notions in articulating the fundamental principles of his political, social and educational theory.[4] Indeed, I want to suggest that it is an over-simplification of Russell's account of philosophy to suppose that there is no conceptual link between his "scientific philosophy" and his political, social and educational thought. In order to do so, it is necessary to examine his account of scientific philosophy in some detail.

In "On Scientific Method in Philosophy" Russell argues against philosophical systems derived from ethics and religion in favour of those derived from science. Scientific philosophy emancipates itself from the bias of ethical notions by the tentative pursuit of objective fact:

> The view of the world taken by the philosophy derived from ethical notions is thus never impartial and therefore never fully scientific. As compared with science, it fails to achieve the imaginative liberation from self which is necessary to such understanding of the world as man can hope to achieve, and the philosophy which it inspires is always more or less parochial, more or less infected with the prejudices of a time and a place.[5]

The person engaged in scientific philosophy, however, enlarges his philosophical understanding to incorporate the universal and sweep

[4] For a full, philosophical analysis of Russell's early "organic" conception of the individual, as contained in *Principles of Social Reconstruction*, see Howard Woodhouse, "The Concept of Growth in Bertrand Russell's Educational Thought", *Journal of Educational Thought*, 17, no. 1 (April 1983): 12–22.
[5] "On Scientific Method in Philosophy", in *Mysticism and Logic* (London: Longmans, Green and Co., 1918), p. 109. *Cf.* "The Place of Science in a Liberal Education", *ibid*, pp. 42 and 44.

away the particularities of his position in space and time. The distinguishing features of philosophy are determined by the nature of philosophical propositions. These are twofold, namely general and *a priori*. A general proposition refers not to any specific entity or set of entities but is applicable to "everything that exists or may exist" (p. 110). Russell has in mind the propositions of logic, since they are true of all possible worlds and not simply the world of sense experience (p. 111). The second criterion of being *a priori* also points to logic as the paradigm of philosophical inquiry:

> A philosophical proposition must be such as can be neither proved nor disproved by empirical evidence. Too often we find in philosophical books arguments based upon the course of history, or the convolutions of the brain, or the eyes of shell-fish. Special and accidental facts of this kind are irrelevant to philosophy which must make only such assertions as would be equally true however the actual world were constituted. (*Ibid.*)

Again, evidence supporting philosophical propositions based on the particularities of empirical science is to be avoided in favour of *a priori* truth. Philosophical propositions do not refer to the world of sense experience but to all possible worlds. As a result, Russell refers to philosophy as the science of the possible (or the general) and emphasizes that it is indistinguishable from logic (pp. 111–12). Logic in turn possesses two characteristics:

> The study of logic consists, broadly speaking, of two not very sharply distinguished portions. On the one hand it is concerned with those general statements which can be made concerning everything without mentioning any one thing or predicate or relation, such for example as "if x is a member of the class α and every member of α is a member of β, then x is a member of the class β, whatever x, α, and β may be." On the other hand, it is concerned with the analysis and enumeration of logical *forms*, i.e. with the kinds of propositions that may occur, with the various types of facts, and with the classification of the constituents of facts. In this way, logic provides an inventory of possibilities, a repertory of abstractly tenable hypotheses. (P. 112)

Thus logic is concerned, on the one hand, with universal propositions, which in quantified form are conditional propositions making no reference to particulars. On the other hand, it is concerned with the investigation of logical forms—for example, the forms of arguments used by Newtonian physics in establishing the laws of motion. By enumerating these various argument forms, the subject-matter disappears and the

structure of Newtonian physics becomes indistinguishable from that of other branches of human knowledge.

Most interpreters of Russell have inferred that his account of scientific philosophy excludes political and educational philosophy. After all, it is hard to see how political philosophy could meet the criteria just laid down. The propositions of political and educational philosophy necessarily refer to human beings and are hence neither general nor *a priori*.[6] For example, in an otherwise excellent recent work, John Passmore writes as follows:

> One could not possibly guess, reading *On Education*, that Russell was at that time committed to the philosophy of logical atomism. No doubt there is what we call an "attitudinal" connexion—Russell himself once called it a "psychological" connexion—between Russell's educational writings and his philosophical writings: the same spirit of criticism, the same faith in enlightenment, is exhibited in both works. But that is the most we can say.[7]

On the contrary, I shall argue that there is both a psychological and conceptual connexion between Russell's educational and philosophical writings. The former, indeed, exhibit the practical application of many of the theoretical principles enumerated in the latter.

[6] See John G. Slater, "The Political Philosophy of Bertrand Russell", in J. E. Thomas and K. Blackwell, eds., *Russell in Review* (Toronto: Samuel Stevens, Hakkert and Co., 1976), esp. pp. 140–2. Others who take issue with this view include Noam Chomsky, who believes "the humanistic conception of man" to be the link between Russell's analytic and social philosophy: *Problems of Knowledge and Freedom: The Russell Lectures* (New York: Random House, 1971), pp. xi, 50–4. Ronald Jager views Russell's method and metaphysics as the unifying element, particularly his account of freedom: *The Development of Bertrand Russell's Philosophy* (London: George Allen and Unwin, 1972), pp. 428–31. Elsewhere he argues for a striking resemblance between Russell's metaphysical and religious concepts of the self: "Russell and Religion", in Thomas and Blackwell, pp. 110–11. Richard Wollheim suggests there is a closer connection than Russell indicates without saying what it is: "Bertrand Russell and the Liberal Tradition", in George Nakhnikian, ed., *Bertrand Russell's Philosophy* (London: Duckworth, 1974), p. 209. John Lewis, *Bertrand Russell, Philosopher and Humanist* (New York: International Publishers, 1968), pp. 10 and 84–5, argues for a relationship between Russell's logical and social atomism. Louis Greenspan suggests that Russell's remarks have spawned a "sterile debate" concerning the relationship between his "technical philosophy" and "popular writings": *The Incompatible Prophecies: An Essay on Science and Liberty in the Political Writings of Bertrand Russell* (Oakville, Ont.: Mosaic Press, 1975), pp. 11–12. But he believes Russell's political philosophy to be based on the principles of "Whig Socialism" (p. 73).

[7] *The Philosophy of Teaching* (London: Duckworth, 1980), p. 4.

The main problem with Passmore and others' interpretation is not only that it excludes political and educational theory but other areas like philosophical psychology and the philosophy of physics from the domain of philosophy. Nevertheless, Russell certainly believes that these are amenable to the scientific method. The philosophical psychology that he advances in *The Analysis of Mind*, for example, violates the criterion of containing only universal statements, precisely because it is based upon the scientific methodology of behaviourism and neutral monism and the empirical facts that this method has brought to light. By virtue of their subject matter, the statements of this science make reference to both human beings and animals. Indeed Russell claims that his philosophical analysis is influenced by the scientific advances in both modern physics and modern psychology and their conflicting views of matter. His analysis brings the two together in the following manner: "I think that what has permanent value in the outlook of the behaviourists is the feeling that physics is the most fundamental science at present in existence."[8] The important point here is that Russell's strict definition of philosophy, as indistinguishable from the *a priori* truths of logic, is modified during his career to include the empirical truths based upon advances in the natural and social sciences. Thus scientific philosophy comes to include not only logic but the methods and findings of empirical science.[9] Russell indeed claimed at the International Congress for Scientific Philosophy in 1935 that scientific philosophy had finally caught up with natural science in making its method a synthesis of the *a priori* and the empirical:

> In science, this combination has existed since the time of Galileo; but in philosophy, until our time, those who were influenced by mathematical method were anti-empirical, and the empiricists had little knowledge of mathematics. Modern science arose from the marriage of mathematics and empiricism; three centuries later, the same union is giving birth to a second child, scientific philosophy, which is perhaps destined to as great a career. For it alone can provide the intellectual temper in which it is possible to find a cure for the diseases of the modern world.[10]

[8] *The Analysis of Mind* (London: George Allen and Unwin, 1921), p. 5. In addition to its method, Russell embraces physics as the fundamental science because of the generality of the truths that it contains. He suggests that it contrasts with psychology by virtue of the nature of its causal laws, not its subject matter (*ibid.*, pp. 287–307).

[9] As Russell puts it in criticizing linguistic philosophy's lack of concern for the nature of the world and our relation to it: "The only reason that I can imagine for the restriction of philosophy to such triviality is the desire to separate it sharply from empirical science. I do not think such a separation can be usefully made. A philosophy which is to have any value should be built upon a wide and firm foundation of knowledge that is not specifically philosophical" (*My Philosophical Development*, p. 230).

I want to suggest that if we examine Russell's description of the scientific method in philosophy there is no reason to suppose that it excludes political, social and educational philosophy. Indeed the relative inexactitude that may belong to these fields is an integral part of the scientific method as he describes it. While the state of scientific knowledge in education (a precise analysis of the behaviour of the individual in early childhood, for example) is less advanced than that in physics (the scientific analysis of matter), this does not imply that the former is not amenable to the scientific method. It may simply be that its subject matter is more complex and, as a result, the state of the science less well developed.

In *My Philosophical Development* Russell describes the scientific method in the following terms:

> My method is invariably to start from something vague but puzzling, something which seems indubitable but which I cannot express with any precision. I go through a process which is like that of first seeing something with the naked eye and then examining it through a microscope. I find that by fixity of attention divisions and distinctions appear where none at first was visible, just as through a microscope you can see the bacilli in impure water that without the microscope are not discernible. There are many who decry analysis, but it has seemed to me evident, as in the case of the impure water, that analysis gives new knowledge without destroying any of the previously existing knowledge. This applies not only to the structure of physical things, but quite as much to concepts.... Belief in the above process is my strongest and most unshakable prejudice as regards the methods of philosophical investigation. (P. 133)

Three aspects to Russell's concept of philosophy emerge from this description of his method:

1. The scientific method itself is analytic (i.e. it breaks down complex phenomena into their constituent parts in order to examine them more clearly) and applicable both to the investigation of empirical matters and the analysis of concepts. To this extent it can be used in

[10] "The Congress of Scientific Philosophy", *Actes du congrès international de philosophie scientifique* (Paris, 1936), no. 1, p. 11. For a critique of scientific philosophy as positivist see Max Horkheimer, "The Latest Attack on Metaphysics", *Critical Theory* (New York: Herder and Herder, 1972).

the philosophical investigation of the empirical sciences (physics, psychology, politics, etc.) and the *a priori* sciences (logic and mathematics).

2. The successful results of the application of the scientific method in philosophical investigation yields clear, precise knowledge, indistinguishable from science. To this extent, Russell apparently considers both the philosophical analysis of the bases of logic and mathematics in *Principia Mathematica* and the philosophical psychology of *The Analysis of Mind* to be indistinguishable from science. The application of the scientific method may yield scientific knowledge as a result of the philosophical investigation of both the *a priori* and empirical sciences.

3. An indeterminate area where the scientific method has not yet yielded scientific knowledge because the evidence is inconclusive. Many of the traditional problems of philosophy reside here precisely because science has not been able to resolve them. To this extent, philosophy is distinguishable from science simply by virtue of the tenacity with which its problems resist solution.[11] The philosopher is not thereby obliged to resort to mysticism or theology, however. He continues to utilize the scientific method by weighing the evidence in favour of the various propositions before him. He may then take a stand on the basis of the present scientific evidence available and be prepared to revise his position on the basis of new evidence. This aspect of the scientific method is of use in the philosophical investigation of both the empirical and *a priori* sciences and characterizes the tentative manner in which science, in contrast to mysticism, proceeds.[12]

What are the implications of this analysis of Russell's concept of philosophy for his political, social and educational philosophy? First,

[11] I take this to be the meaning of Russell's remarks that "Science is what you know, philosophy is what you don't know" and "Philosophy ... is something intermediate between theology and science ... a No Man's Land" (see Wood, p. 276).

[12] "Mysticism and Logic", *Mysticism and Logic*, pp. 12 and 18. Joe Park correctly describes the scientific flavour of Russell's educational writings as follows: "Russell's ideas on education should be treated as hypotheses, formulated by a widely read and very wise man, *which remain to be substantiated by scientific investigation*. His theory if it may be called that, is not scientific. *It is a second-order 'theory', the kind of thing sometimes one does either before, or as one undertakes, a series of scientific observations and experiments* " (*Bertrand Russell on Education* [London: George Allen and Unwin, 1964], p. 129; my italics).

this is a complex and sophisticated account that suggests that an interpretation that considers these areas as non-philosophical, based only on acceptance of the distinction between Russell's philosophical and popular writings, may be simplistic. Secondly, I wish to claim that Russell recommends the application of the same scientific method with regard to political and educational philosophy. Thirdly, it is clear that the application of the scientific method has not on the whole produced scientific knowledge in political and educational philosophy, though it may be approaching it. Fourthly, the difficulties encountered in reaching scientific knowledge in political and educational philosophy may be related to the nature of the propositions comprising them. Russell is undecided as to whether they constitute knowledge in the strict sense. I shall comment on the last three points in order, since they illuminate the first.

First, as regards method, Russell re-emphasizes the importance of scientific method when writing about the distinguishing features of liberalism in an essay entitled "Philosophy and Politics". Like science, liberalism uses a piecemeal approach to establishing the truth of political propositions:

> The essence of the Liberal outlook lies not in *what* opinions are held, but in *how* they are held: instead of being held dogmatically, they are held tentatively, and with a consciousness that new evidence may at any moment lead to their abandonment. This is the way in which they are held in science, as opposed to the way in which they are held in theology.[13]

As a result of a common method, Russell asserts that the scientific outlook is the intellectual counterpart of liberalism and empiricism the only philosophy to afford a theoretical justification of democracy:

> Science is empirical, tentative, and undogmatic; all immutable dogma is unscientific. The scientific outlook, accordingly, is the intellectual counterpart of what is, in the practical sphere, the outlook of Liberalism.... The only

[13] "Philosophy and Politics", *Unpopular Essays* (London: George Allen and Unwin, 1950), p. 27. H. Parris contests this claim of Russell's concerning method by pointing out that he introduces certain *a priori* assumptions about human nature in the course of establishing his political philosophy. These assumptions are generated not by inductive generalizations (based on a mass of evidence) as Russell suggests, but by deductions made from the history of liberalism: "The Political Thought of Bertrand Russell", *Durham University Review*, 28 (1965–66): 89, and Greenspan, p. 14. Parris' correct observation demonstrates the importance of the liberal tradition of which Russell is a part.

philosophy that affords a theoretical justification of democracy, and that accords with democracy in its temper of mind, is empiricism. (*Ibid.*, pp. 28, 25)

Russell here clearly states that there is both a conceptual and a psychological connection between his political philosophy and scientific philosophy. Just as scientific philosophy avoids the dogmatism of religion, so liberalism, by means of the same scientific method, avoids the dogma of left- or right-wing fanaticism. It is in this sense that Russell suggests that empiricist philosophy alone offers a *theoretical* justification of democracy (thus the conceptual connection). Democracy depends upon the ability of individuals to make rational choices by considering the evidence supporting the various options with which they are presented. Empiricism develops just such capacities in those that study it. As a result, the two agree in their *temper of mind* (the psychological connection). Russell thereby links empiricism, liberalism and democracy by their common distinguishing feature, namely the scientific method. And it is by virtue of this method that he considers his own philosophy as empiricist, liberal and democratic.[14]

Secondly, as regards the scientific status of political and educational philosophy, much may still be in the "No Man's Land" between theology and science, but not all. Two examples illustrate Russell's hope that a correct understanding of the motives of human behaviour may produce a political and educational philosophy that is scientific in nature. First, the psychology that Russell introduces in *Principles of Social Reconstruction* is designed to produce a precise understanding of the willingness with which men engage in the self-destructive activity of war. He conceives of the mainspring of human action as pre-conscious impulse rather than conscious desire. Impulses may be channelled along constructive or destructive paths, according to the kind of opportunity they are given to grow. In the competitive, militaristic environment of modern capitalism they are generally given destructive and possessive opportunities to flourish. Because the process of socialization takes place below the level of consciousness, the activity that it spawns is both deep-rooted and at

[14] Philip Stander makes the same claim for Russell's educational philosophy: "In the case of Russell, I wish to argue that his views on education have all the characteristics of a philosophy of education. This work is consequently offered as an attempt to present Russell's views as a consistent, interrelated totality, a philosophy of education from which we obtain a blueprint for the construction of an educational system compatible with his vision of the good life, his philosophical assumptions and conclusions, and his affirmation of a democratic society" ("Bertrand Russell's Philosophy of Education" [unpublished ED.D. thesis, Columbia University, 1968], p. iv).

times irrational, as in the case of fighting wars.[15] Russell's debt to Freudian psychoanalytic theory, even though he may, at the time of writing *Principles of Social Reconstruction*, have been unfamiliar with the work of Freud himself, is clear and a measure of the regard that he had for its scientific status. Once he questioned this status because of the metaphysical overtones of much of the theory, Russell modified his account of human action by introducing behaviourist theory that is more in line with the methods of science. Thus in *On Education*, Russell conceives of the mainsprings of human action as instinct and reflex, which are quickly overlaid in the child's development by habits. The scientific approach to child-rearing takes this into account in the following manner. Provided that habit-formation starts early enough to develop a sense of discipline in the young child concerning such matters as eating and sleeping, he will develop into a self-disciplined individual.[16] The fearless freedom that Russell wishes the child also to show is based upon the inner control resulting from the early establishment of the correct habits. Their familiarity gives the child a sense of spontaneity, in which he feels his instincts are not thwarted. Russell now articulates an educational philosophy that incorporates some of the less speculative aspects of Freudianism with the scientific, child-rearing methods of behaviourism. To this extent, it is based upon the most recent scientific knowledge from which in time it may become indistinguishable.[17]

Thirdly, as regards the nature of the propositions of political and educational philosophy, Russell regards them as normative and expresses scepticism about the relation of normative statements to knowledge. This scepticism, which is revealed in three different meta-ethical theories in the course of Russell's career,[18] apparently undermines the preceding arguments that his political and educational philosophy is an integral part of his overall philosophy. Yet this point can be over-emphasized, since at the same time that Russell advocates a scepticism about the truth or falsehood of ethical propositions, he nevertheless advocates normative positions with an ardour that he believes to be justified on the basis of the

[15] *Principles of Social Reconstruction*, pp. 13–14, 148–151.

[16] *On Education* (London: George Allen and Unwin, 1926), pp. 70–1, 80, 246–7.

[17] "The Training of Young Children", *Harper's Magazine*, 155 (August 1927): 314. Elsewhere I have also considered this question at some length: "Repression in Bertrand Russell's *On Education*", read to the Bertrand Russell Society, Chicago, 1979.

[18] The intuitionist, emotivist and utilitarian meta-ethical theories that Russell espoused in turn are well analyzed in D. H. Monro's "Russell's Moral Theories", in D. F. Pears, ed., *Bertrand Russell: A Collection of Critical Essays* (Garden City, N.Y.: Doubleday and Co., 1972), esp. pp. 328–9. Only in his intuitionist theory does Russell assert that ethical propositions constitute objective knowledge, apprehended by a moral sense or intuition.

scientific understanding of human affairs. Scientific philosophy finally leads Russell to be both sceptical about the scientific status of ethical propositions, since they are (according to his emotivist theory) expressions of the speaker's approval, and ardent in articulating moral viewpoints, based upon a respect both for the scientific attitude and a humanistic understanding of mankind. As Munro puts it:

> Even in his most popular works, Russell never loses sight of the philosophical problems in his concern for the political or psychological ones, and he certainly has views on meta-morals and meta-politics as well as on morals and politics. Indeed, his attempts to reconcile the two are highly illuminating; for they show one of the clearest minds of our time faced with one of the central problems of our time: how to justify passionately-held moral convictions when all the evidence seems to lead to moral scepticism. (*Ibid.*)

Thus Russell may be seen as a moral philosopher who expresses both a scepticism about the ultimate justification of ethical propositions and a fundamental belief that certain values (science, individual freedom, etc.) are worth defending.[19] These values are based upon certain convictions of Russell's that he wishes to see realized both in himself and in the population as a whole. They result from his vision of what mankind might become given the correct set of political, social and educational institutions. At the same time, the political and educational philosophy that Russell articulates is based, as far as possible, upon a scientific understanding of human beings and the ways in which they can best realize their potential. To this extent, Russell's political, social and educational philosophy is consistent with his advocacy of the scientific method. For the scientific method may be essential in discovering the means to the construction of the good society but the end to which it leads (namely, the type of society this is to be) can only be determined by what human beings want. On this point, Russell consistently agrees with Hume that reason can only determine the means to an end while passion determines the end itself and is the cause of action.[20]

[19] Bertrand Russell and Mortimer Adler, "Debate: Are There Absolute Principles on Which Education Should be Founded?" (Chicago: Lecture Reporting Service, 1941).

[20] See *Human Society in Ethics and Politics* (London: George Allen and Unwin, 1954), pp. vi–vii. *Cf. Principles of Social Reconstruction*, pp. 12–14. A. J. Ayer states that Russell assimilates ethics to science in *Human Society in Ethics and Politics* by defining the ethical term "good", as descriptive of an occurrence that both satisfies desire and is approved of by either one individual or the majority of mankind. See A. J. Ayer, *Russell* (London: Fontana/Collins, 1972), p. 124.

In conclusion, I wish to make three points. First, to reiterate that there is a conceptual connection between Russell's political, social and educational philosophy and his scientific philosophy. Both the scientific method and some of the empirical evidence resulting from its use (e.g. the necessity of early habit-formation for leading a healthful life) are in evidence in his political and educational philosophy. Secondly, at the very least Russell is engaged in doing political and educational theory in his "popular writings". It makes sense, therefore, that he should use both the methodology and concepts integral to his philosophical outlook in the construction of this theory, even if they do not receive the explicit clarification one would expect in the "technical writings" comprising his scientific philosophy. Thirdly, Russell's educational theory is, in fact, an integral part of his general outlook and may justifiably be referred to as an "educational philosophy".

As a result, it is both illuminating and, indeed, necessary to refer to Russell's philosophical psychology in order to clarify some of the concepts used in his educational philosophy (e.g. the concept of instinct used in *On Education* becomes clearer in the light of his examination of it in *The Analysis of Mind*[21]). Failure to understand the link between Russell's philosophy and his social, political and educational thought will result in a continuing and superficial view of the lack of continuity between the two sets of writings. Such a view will continue to ignore the important set of questions that Russell was attempting to answer in his more popular writings. But philosophers will only do so at their peril, since the questions that Russell raises in these works are well worthy of their study. They are the perennial questions posed by the great philosophical tradition of which Russell is an important part.

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[21] A fuller analysis of this connection is made in my "The Concept of the Individual in Bertrand Russell's Educational Thought" (unpublished PH.D. thesis, University of Toronto, 1980).