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ABSTRACT

The distinction between qualitative and quantitative modes of research has become fashionable in recent years. Few accounts, however, clarify the distinction. This paper, then, is a contribution to the quality/quantity debate. It locates the origins and basis of such distinction in a split between "natural history" and "hypothetico-deductive" methods that occurred in the seventeenth century Scientific Revolution. In turn, it is assumed that an appreciation of these early developments in scientific thinking is still germane to twentieth-century discussions. (Author)

On the origins of the distinction between quality and quantity

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The distinction between qualitative and quantitative modes of research has become fashionable in recent years. Few accounts, however, clarify the distinction. This paper, then, is a contribution to the quality/quantity debate. It locates the origins and basis of such a distinction in a split between 'natural history' and 'hypothetico-deductive' methods that occurred in the seventeenth century Scientific Revolution. In turn, it is assumed that an appreciation of these early developments in scientific thinking is still germane to twentieth-century discussions.

Since joining the educational research work force I have noticed significant changes in its technical language. Words like curriculum and hermeneutics have acquired a multiplicity of meanings. Other terms have been replaced by synonyms (e.g. 'ethnography' for 'anthropology'). New terms - like 'phenomenological', 'reconceptualist', 'postmodern'- have become fashionable; while other labels - like 'psychometric' and 'norm-referenced' - have fallen from grace.

What should be made of this semantic turbulence? Much of it reminds me of a definition that circulated in the 1960s: an educational researcher is someone who can leap from bandwagon to bandwagon without interrupting their flow of jargon. Are

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changes in language, therefore, merely changes in the superficial packaging of research practice? Or are they symptomatic of more profound shifts in the epistemological context of educational inquiry? No doubt, many changes can be regarded as evolutionary 'sports' - little more than ephemeral neologisms. Yet, even these terminological mayflies must have come from somewhere.

The changing language of educational research, therefore, is always open to etymological analysis. Indeed, I feel that there is much to be gained if students of education adopted a **Keywords** (cf. Williams, 1976) approach to research practice (or methodology). A keywords approach, I believe, has a dual value: it can sensitise researchers to the general embeddedness (or historicity) of social practice while, at the same time, it can enhance the wisdom of their own inquiries.

To return to the terms quality and quantity. For a number of years I have observed the wide, even promiscuous, use of these terms. At the same time, however, I have also been irritated by their misuse. For instance, it is regularly assumed that the quality/quantity distinction is isomorphic with the distinction between words and numbers (for a recent example see Hopkins et. al. 1989, p. 62). In fact, this is an unfortunate over-simplification. Many quantitative terms - like 'more' and 'greater than'- cannot be expressed in numbers. Thus it is perfectly possible to write a number-free quantitative account.[2]

Accepting these conceptual difficulties, I was still left with the question: 'What is (or might be) meant by quantitative and

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[2]Note, for instance, the contrasting position taken by Glaser & Strauss: the 'clash' between discussions of quantitative versus qualitative methods concerns 'the primacy of emphasis on verification or generation of theory' (1968, p. 17).

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qualitative?'. In further pursuit of this topic, I turned to the ERIC database. A cursory search through the CD-ROM version of ERIC indicated that many recent authors do, indeed, file 'qualitative' and 'quantitative'as descriptors. Yet, upon further inspection, few ERIC authors seem to have focused any analytic (rather than rhetorical) attention upon the use of these terms.

For instance, the most recent ERIC CD-ROM (March,1983 to March, 1989), includes 66 titles containing 'qualitative' and 'quantitative'; four titles containing 'qualitative' and 'methodology'; and three titles containing 'quantitative' and 'methodology'.[3] But even further scrutiny of these citations failed to meet the demands of my enquiry.

In the event, the incentive and material for this paper arose elsewhere - from something I discovered while researching a different argument. Mary Slaughter's Universal Languages and Scientific Taxonomy in the Seventeenth Century (1982) contains the following sentence: 'Newton's work established the pre-eminence of quantitative analysis as opposed to the qualitative analysis upon which classification is based' (p. 194). This was an unexpected historical angle on the qualitative/quantitative distinction. Needless to say, I was curious enough to clarify Slaughter's provocative proposition.

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In the early part of the seventeenth century, Francis Bacon (1561-1626) redirected the attention of philosophers away from

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[3]My Liverpool colleague, David Thomas, recently went on-line to ERIC, combining the descriptors 'qualitative' and 'critique'. The search identified five titles.

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the study of classical texts to the examination of 'nature'. Just as the world was being opened up through navigation and commerce, so comparable wealth could be gained through the discovery and accumulation of information about the world (i.e. [hu]mankind's estate]. Bacon's methodology - presented in the Novum Organum (1620)- replaced the relatively 'haphazard'(Losee, 1972, p. 63) data-collection procedures of Aristotle. Nevertheless, it still remained within an Aristotelian framework[4]. Like Aristotle, that is, Bacon viewed the universe as a collection of substances with properties and powers. Bacon referred to these attributes as 'forms' or 'natures' whereas Aristotle labelled them as 'essences'. Further, Aristotelian thought assumed that such forms, natures or essences could be apprehended, distinguished and labelled by the human mind. Thus, seventeenth-century aristotelian science was based, among other things, on three activities: the collection, classification and labelling of data. Furthermore, the labelling exercise was greatly assisted by the contemporaneous belief that there is an isomorphic relationship between words and things - a relationship extensively examined in Mary Slaughter's Universal Languages and Scientific Taxonomy in the Seventeenth Century and Michel Foucault's Les Mots et les Choses (1966)[5].

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[4]Bacon's Novum Organum was self-consciously compiled to replace the Organon, a medieval 'reader' of Aristotle's writings.

[5]English translation as The Order of Things: an Archaeology of the Human Sciences (1973).

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For Aristotelians of a Baconian disposition, the purpose of science was fulfilled when the world of essences had been duly gathered into the book of knowledge. Aristotelian natural science, therefore, was little more than a celebration of fact-gathering. It was, according to Patricia Reif (1969, p.20), an exercise in creating 'giant encyclopedia' of 'diverse and sprawling... information on every conceivable topic'.

The qualitative paradigm, I suggest, had its roots in these neo-aristotelian principles. But, in fact, its pre-eminence was eclipsed by events in the latter part of the century. Four developments - culminating in the work of Newton - seem to have been historically significant.

First, widespread attention began to be given to atomistic thinking, especially through the work of Robert Boyle (1627-1691). In The Origins of Forms and Qualities (1666), Boyle argued that matter consisted of aggregates of invisible particles whose 'hitting against one another' (Boyle, quoted in Slaughter, 1982, p. 195) accounted for the different phenomena of nature. Boyle, for instance, held that the essential-ness of the metal gold was not in its colour or hardness but, rather, in the motion and configuration of its imperceptible particles. In short, Boyle, raised a problem that has bedeviled taxonomists ever since; namely, that

classifications based on appearance never embrace the truly naturalorder of things.

The second seventeenth-century development was associated with John Locke (1632-1704) and, in particular, with his Essay Concerning Human Understanding (1690). Locke's discussion drew together various lines of thought that exercised early members of the Royal Society of London. These included 'What is the relationship between the things of nature, our ideas of nature and our words for them?'. Assuming that nature is, indeed, atomistic, Locke pondered how such (invisible) corpuscularity operates on human consciousness. Ultimately, Locke's contribution - not only to science but also to Western philosophy - was that he broke the necessary connection between the nature of reality and ideas and words in the mind. Thus, for Locke, accounting for reality was far more complex than for many of his predecessors.

The third development is associated with the seventeenth-century botanist John Ray (1627-1705). A fore-runner of Linnaeus (another aristotelian), Ray was an essentialist, drawing up tables of plants in the 1660s according to Aristotelian ideals. Yet, Ray found great difficulty in identifying the essential characteristics of plants (e.g. how, in aristotelian terms, could the essential properties be distinguished from the accidental properties?). Under the impact of Locke's ideas, however, Ray made a major break with

Aristotelianism in the 1690s. He affirmed the Lockean viewpoint that insofar as essences are unknowable, classification can only be derived from appearances. According to Slaughter, 'Ray adopt[ed] Locke's position that the form in nature and the species of classification are two different things, the latter division having been created by the mind of man for convenient communication' (1982, p. 211). In effect, Ray established the viewpoint that all taxonomic systems (and nomenclatures) are artificial and nominal rather than natural and real.

The final blow to the Aristotelian paradigm of science was foreshadowed in Isaac Newton's Principia mathematica (1687). . Newton's work - whose english title was Mathematical Principles of Natural Philosophy - proposed (or demonstrated) that scientific knowledge is gained not through empiricism alone (i.e. the collection and classification of data) but, rather, through empirical observation linked to theoretical propositions or axioms (e.g Newton's three laws of motion). Newton, that is, formulated an early version of the hypothetical-deductive method: observations are judged according to an axiomatic system (i.e. a mathematical model) which can be revised in the light of new observations (see, for instance, Losee, 1972, p. 92).

Ultimately, therefore, Newton's work was important to the scientific revolution in that it redirected the end of

science. Henceforth the goal of science was not so much as the identification and classification of essences, as the formulation of mathematical models relating to the 'behaviour' - past, present and future - of the natural world. In a paradoxical sense, the seventeenth-century search for a universal language was highly successful - for mathematicians, not for linguists.

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This paper has offered an account of the circumstances and issues surrounding the emergence of the qualitative/-quantitative distinction. It identifies this development with two events: (1) the break-up of a world view that assummed an isomeric relationship between words and things; and (2) the rise to prominence of mathematical/philosophical modelling. But is there any twentieth-century significance to these changes? Or should this paper be read merely as an antiquarian footnote to the history of the natural and social sciences? I am unsure. Certainly, it begs many questions about the subsequent careers of the aristotelian and newtonian world-views. Nevertheless, it also retains a measure of contemporary relevance in that the issues engaged by Boyle, Locke, Ray and Newton (e.g. with respect to taxonomic practice) still merit attention in the late twentieth century. Likewise, the existence of distinct seventeenth-century communities of aristotelian and newtonian thinkers raises a

series of kuhnian questions about subsequent careers of these intellectual communities and their associated paradigms (Kuhn, 1970, p. 174ff.). What happened to them? Did their paradigms survive intact until exploited by social scientists in the twentieth century (e.g. the neo-aristotelianism of Glaser & Strauss's 'conceptual categories and their conceptual properties', 1970, p. 35)? Did the early communities eventually dissolve themselves by appealing to unexamined eclecticism (like Hopkins et al.)? Or, by contrast, have new post-newtonian communities/ paradigms emerged since the seventeenth century?

To conclude: I do not regard these as antiquarian questions. Quite the contrary. I believe they occupy (or should occupy) an important place in the collective consciousness (or common sense) of social research. Without them, I suggest, students and researchers will never know what they are doing.

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