



Quantification and the Accounting Ideal in Science

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● ABSTRACT

Objectivity in science has normally been defined by scholars as almost synonymous with realism. It may be advantageous to think of it instead in terms of impersonality, an ideal that would replace arbitrariness, idiosyncrasy and judgment by explicit rules. Accounting is an exemplar of this aspect of objectivity. More important than the true representation of deep underlying financial identities is the maintenance of a system of rules that blocks self-interested distortion. Otherwise, tax codes and corporate reports would lose their credibility. From this standpoint, quantification appears as a strategy for overcoming distance and distrust. This pertains also to the natural sciences, where measurement and statistics have been crucial in transforming local experimental skills into public knowledge. We need to understand quantification as a response to a set of political problems, part of the moral economy of science. Its use in science is analogous in important ways to the explicitly political and administrative purposes served by accounting.

Quantification and the Accounting Ideal in Science

Theodore M. Porter

Objectivity, V , may be defined to be:¹

$$V = \frac{1}{n} \sum_{i=1}^n (x_i - \bar{x})^2$$

Historians and sociologists of science are scarcely more likely to look to studies of accounting for inspiration than are natural scientists. A hierarchy of science that almost everyone now views as discredited continues nevertheless to regulate our practice. Among those who write of natural science as a model of intellectual endeavour, this is perhaps not unexpected. But it is powerful testimony indeed to the continued hegemony of physics when sociologists of science pursue a social and political understanding of technology, medical economics,

and expert witnessing mainly by applying the lessons learned in the study of harder sciences.² I shall defend here the converse proposition, that we can learn a good deal about making natural knowledge from careful study of a less exalted – though by no means less important – disciplined practice, accounting.

Those who feel unease at this departure from the respectful contemplation of the natural scientist at work can draw inspiration from the example of Charles Darwin among the pigeon fanciers.³ The fanciers cultivated the keenest visual discrimination, and Darwin found them busily engaged in breeding ever more bizarre pouters, puffers, and tumblers. Yet they were oblivious to the magnitude of their own achievements, and scoffed in unison at every suggestion that their varieties derived from common origins. Darwin narrates all this with elegant irony. Naturalists would recognize the myopia of pigeon fanciers, who believed their varieties to be separate acts of divine creation. And yet, by implication, they are scarcely less myopic in insisting on the separate creation of what they call species.

In a similar way, the splendidly Byzantine rules governing tax law and financial reporting are unmistakably the creation of ingenious accountants, in alliance and conflict with lawyers, courts and legislatures. And yet accountants are almost unanimously unwilling to take credit for their own handiwork. Like most natural scientists, they believe that the history of their discipline is mainly a matter of discovery and clear reasoning. And, as with Darwin's naturalists, those who doubt this may not be able to confine their doubts to the subject matter of accounting.

The Objectivity of Accounts

The accountants' view of their field as largely autonomous and technical in nature has, since the late 1970s, been challenged on a wide front. There is now something like a school of accounting sociologists, including a few historians. Their principal journal, *Accounting, Organizations, and Society*, is obligatory reading for academic accountants, and even has acquired a reputation among social scientists, though it seems to be *terra incognita* for historians of science. Their papers are full of references to Foucault, Latour and Hacking. They have conferences on topics like deconstruction and accounting.⁴ Their standing inside accounting has been compared to that of critical legal studies in law.⁵ They are, in some very interesting

ways, more extreme in their pursuit of a social interpretation of knowledge than all but a few writers in science studies. Extremism in the deconstruction of accounting, though, is no vice. The profession of grey suits, grey countenances, and grey figures on white paper, exerts an effective tyranny even over people who on principle would refuse to regard an experimental result in physics as anything more than a brilliant rhetorical ploy.⁶ But we can learn from them about more than accounting. Their work is especially helpful for understanding the uses of quantification, and for constructing something like a social history of objectivity.⁷

In accounting, objectivity means first of all rules. Accounting realists might think that these rules should be dictated by deep and abiding financial entities.⁸ Even the rest of us ought to concede that there is a logic to accounting standards, recognizable sometimes by its presence and sometimes by its absence. There is no question but that these rules must be negotiated. That negotiation brings out the problem of replication and stability in an especially acute way. The challenges that accounting rules must withstand are often more severe than in natural science. They face unremitting efforts to take them apart, to chip away at their boundaries.⁹ Science, following an influential pronouncement of Bruno Latour and Steve Woolgar, is now often perceived as an agonistic field,¹⁰ but scientists for the most part share an interest in building stable structures of knowledge and practice. Those who want to defend accounting rules, in contrast, are vulnerable to the hostile intentions of numerous outsiders. They must hold out against legions of endlessly inventive corporate attorneys and managers who are forever trying to carve out tax loopholes, or to avoid disclosing the extent of their exposure to potential loan defaults, or to shift assets out of a foundering savings and loan into the private account of the owner's children, or the local senator's political campaign.

It is instructive to consider what gives strength and stability to the principles of accounting. I propose a twofold answer: rules and entities. Now these are rarely found in isolation, but I want to pull them apart for analytical purposes. By rules I refer to purely arbitrary, unsupported conventions. Their legitimacy depends above all on their evenhandedness and inflexibility. Like the notorious French law that prohibited rich and poor alike from sleeping under bridges, they permit the homeless as well as (American) professors to invest in 403b tax-sheltered retirement accounts. Entities appeal for their authority to something like the nature of things – to rigorously

defined financial concepts and to the results of arms-length transactions in the world of finance and banking. Accountants, like physicists, prefer their rules to appear to be grounded in the nature of things. But it is often necessary to compromise in the interests of standardization and enforceability. Thus the newly established American Securities and Exchange Commission (SEC) decreed during the Depression that corporate book value should be based on original cost of assets, not their replacement value (which seemed closer to being correct), because investors were already nervous enough and direct cost accounting seemed to leave a minimum of room for self-interested manipulation.¹¹

This particular compromise was an epochal one for American financial accountants, or at least for accounting researchers. The evident incompatibility between rationality and expediency has continued to grate for more than half a century. It gave rise in the 1960s to a revealing literature on the nature of objectivity, works we can now recognize as unsung classics in science studies. Without exception, accountants recognized objectivity as a defence against the suspicions of meddling outsiders. The paramount need to minimize the appearance of subjective discretion – ‘managerial whim’ – in financial reports was stressed in almost every accounting discussion of objectivity.

Typically, as we would expect, realism and constraint were seen as allies. Thus the *Accountants' Handbook* characterized ‘objective’ as implying ‘the expression of facts without distortion from personal bias’. But there was ample reason to worry whether ‘the facts’ were univocal. ‘Objective facts need not be conclusively objective to be dependable’, declared one prominent source.¹² Any departure from established methods, and especially any valuation resting on nothing more than the accountants’ own judgment, was likely to cause trouble. The fundamental choice between present value and cost as a basis for financial accounting was conditioned by such considerations. To abandon accounting according to original costs, cautioned Harold Bierman in 1963, would oblige accountants to face ‘a variety of choices’ – whether, for example, to adjust financial quantities only to take account of changing price levels, or to base value on expected future cash flows, or even to use liquidation prices. ‘The accountant’s task would be more complex’, he noted. ‘The above suggestions would lead to manipulation of the reports’, and would add to the regulatory burden on the SEC.¹³ Still, he thought accountants should accept this inconvenience, in the interests of a better representation of

the true state of affairs. Bierman preferred not to dilute rationality with expediency, and he envisioned accounting as a measurement discipline analogous to astronomy and psychology. There is a hint here of the ivory tower, where academic accountants can adhere to high ideals with blissful disregard for the exigencies of practice in a suspicious and bureaucratic world. Working accountants in business and government have learned to maintain their guard against those flights of theoretical fancy arising among the professors.

Bierman's moderate defence of accounting realism proved an impossible compromise, and not only because it seemed unworkable to the 'practical men'. On the one side, accounting realists challenged severely the view that anything other than truth could be really useful. In accounting, as in other sciences, wrote the Australian R.J. Chambers, we can only claim objectivity when we know what we measure. If our objects are not defined, 'it is quite impossible to speak of eliminating known biases and discovering true or estimated measures'.¹⁴ True values must be contemporary values; historical cost is meaningless until revised to reflect current conditions. Conventional rules cannot suffice to manufacture objectivity; an objective statement must be one that any other informed person would make about the same subject matter. That informed persons will agree about the proper rationality of accounting, and about the detailed ways in which this could be worked out in practice, was evidently to be deduced from the very nature of properly scientific inquiry, because Chambers gave no arguments. Such an identity, in the nature of things, between accounting truth and unambiguous rules was asserted in the same year by his ally Edward J. Burke. He invoked the Kantian understanding of explanation as the subsumption of particulars under law to ground accounting rationality, and at the same time to explain how it could be made invulnerable to 'emotive considerations'.¹⁵

Unfortunately, as Bierman recognized, it was far from clear that accounting realism provided the most effective grounding for impersonal rules. Quite different implications were drawn out the next year by John Wagner, who wanted to see accounting as a liberal profession, like medicine. This preference for expert judgment over standardized rules was common among elite accounting practitioners, who resisted the inflexible rules backed by academics and government regulators.¹⁶ Wagner issued the following unanswerable syllogism:

The accounting profession's prime asset is an attribute known as *professional judgment*. Judgment, professional or otherwise, is a product of the mind. If judgment must be made synonymous with subjectivity, we cannot have objectivity and a profession at the same time. Clearly we cannot accept such a view of objectivity. Rather, we must show that the exercise of professional judgment and the desire for objectivity are complementary propositions.

A visual metaphor saved the realists' objectivity, which henceforth should mean 'a relative absence of perceptual defects in the exercise of professional judgment'. Discipline, also, was indispensable. Accountants properly imbued by a strict training with general principles and goals would command a form of judgment 'more effective, more controllable, in attaining a desirable state of objectivity'.¹⁷

Discerning judgment is almost always subordinated to the straightforward presentation of numbers in the public rhetoric of accounting. We cannot infer from this the state of mind of accountants, as if they all believe that numbers, collected and processed mechanically, tell all. Not only critics, but many leading spokesmen for accounting, have argued that the exclusive identification of accounting with numbers on a balance sheet is a straitjacket. A recent historical study, largely uninfluenced by the new constructivism in accounting, laments the increasingly mechanical use of management accounting by uninspired executives trained to manage 'by the numbers', and attributes this stultifying drive for rigour in large measure to the external imposition of financial reporting conventions.¹⁸ The new hermeneutics of accounting goes only a little way beyond the pronouncements of the old accounting élite when its champions argue that a language of inference and interpretation, resting on the discernment that comes with true expertise, could provide much more helpful guidance to stockholders and creditors than a string of numbers.¹⁹ The point is that this interpretive form of accounting would depend on a great reserve of trust, and it is precisely because trust is in short supply that so much emphasis is placed on the accounts in the first place. Accountants, operating in a highly contentious domain, lack the status and credibility that would permit them to rest their claims mainly on wisdom and insight. It is in large measure for broadly political reasons that a positivistic rhetoric of impersonal facts prevails in accounting. Seemingly rigorous standards are at least as valuable as claims to represent real entities in securing the faith of outsiders in accounts.

The need for impersonality is reflected in the prevailing conception of objectivity among accountants. Yuji Ijiri and Robert Jaedicke,

whose pioneering quantitative definition of objectivity is cited in the epigraph to this paper, complained against the realists that existence independent of observers has no operational meaning in the context of accounting. The problem faced by accountants is simple: 'Accounting is a measurement system which is plagued by the existence of alternative measurement methods'. The remedy seemed scarcely less simple:

If the measurement rules in the system are specified in detail, we would expect the results to show little deviation from measurer to measurer. On the other hand, if the measurement rules are vague or poorly stated, then the implementation of the measurement system will require judgment on the part of the observer.

Objectivity, for these accountants, was a mechanism to exclude judgment. It could be 'defined to mean simply the *consensus* among a given group of observers or measurers', and hence measured (inversely) as a statistical variance. Its importance was not so overwhelming as to exclude consideration of reliability, meaning ability to make accurate predictions. But it was by no means to be discarded lightly, for without consensus there could be no reliability either.²⁰ Practising accountants and researchers alike found this reasoning plausible, even compelling. Practitioners were acutely conscious that reaching agreement by following rules provided their most powerful defence against government bureaucrats. Researchers applauded the quantitative form of objectivity for its amenability to empirical, meaning statistical, research, and on this account it became the consensus concept of objectivity in accounting.²¹ Nor were research accountants immune to the allure of 'perfect operational objectivity', which could be realized 'only where the entire accounting process was reduced to programmable sets of procedures'.²²

This insistence on standardizability, even where it violates the best judgment of expert practitioners, will rarely be found except in fields that are highly vulnerable to criticism from outsiders. The conspicuous exercise of personal discretion in the preparation of accounts tends, for obvious reasons, to raise doubts, and for this reason the community of accountants is exposed and in this sense weak. In the United States, the pursuit of standardization has been perhaps the most important activity of the leading professional organization, the American Institute of Accountants. The main reason for this avid pursuit of uniformity, as John Zeff points out, is to forestall 'active involvement by government in the establishment of accounting principles'.²³

Still, while uniform standards are highly valued, a gap between methods and reasons is an embarrassment too. And the relationship is not normally one of conflict. More typically, uniformity and standardization are enhanced by the ostensible rationality that comes from explicit theoretical reasoning. Robert Ashton, who subjected a population of accountants to a sample survey in order to measure the objectivity of rival accounting methods, was pleased to find that the theoretically-preferred measure, present value, was indeed more objective (that is, showed a lower standard deviation over different measurers) than its rival, accounting by original cost.²⁴ When, in the late 1940s, the United States Bureau of the Budget wanted to make cost-benefit analysis into an effective brake on the Congressional pork barrel, the application (for the first time) of economic reasoning was immediately recognized as valuable for standardization.²⁵ It was hard to decide between the diverse practices of various agencies, and to define a coherent, single, authorized practice, except by using the terms of reasoned argument. In practice, rules are most often based on some claim to rationality. Conversely, and despite increasingly persuasive philosophical reservations, it has become very difficult successfully to press claims to scientific rationality for what is not at least potentially reducible to rules.

A Technology of Distance

It is important to note that the form of knowledge resulting from this relatively rigid quantitative protocol is decidedly public in character. Such knowledge is especially useful to coordinate the activities of diverse actors, and to lend credibility to forms of belief and action when personal trust is in short supply. Objectivity is a technology of distance: geographical, intellectual and social. In the (admittedly somewhat mythical) *Gemeinschaft*, face-to-face interactions typically obviated the need for the formal structures of objectivity. We know this from studies of the history of measurement, such as Witold Kula's *Measures and Men*, where we learn that until the eighteenth century, measurements even of land or grain volume were never intended to be purely mechanical, but normally involved an explicit judgement of quality. In a small-scale and unstandardized world, bargaining over measures caused no more inconvenience than bargaining over prices. And even in less intimate situations, where people exercise power by divine right or personal charisma, they will rarely

allow their judgment to be supplanted by standardized, objective calculations. Objectivity empowers weak authorities, even as it constrains them.²⁶

Accounting, especially, is associated with particular ways of organizing political and economic activity. The accounts of individual entrepreneurs and small partnerships rarely amounted to more than ledgers of income and expenditure, until an increasingly burdensome tax law brought greater rigidity to these things. Alfred Chandler and his followers have shown to what extent the development of cost accounting was associated with the growth of complex, integrated firms, and later with government regulation.²⁷ The ambit of accounting, in short, is first of all administrative, and not cognitive. Indeed, its contribution to the management of business firms is at least matched in importance by its role in mediating between business and government, or business and the public. The accounting profession got its start in nineteenth-century England, where its members exercised the very public function of presiding over bankruptcies and assuring creditors they would be treated fairly. American and British accountants also began early to audit the accounts of public companies, and thus to provide independent and expert assurance to shareholders and other interested parties that the books were fair and honest.²⁸ The purposes of accounting and related forms of quantification are to be understood not mainly in terms of a logic of market capitalism, but of political values – usually some mix of justice, openness and restraint on personal discretion. Their force depends on types of human communities, on forms of power. Objectivity is synonymous with public knowledge in a deeper and more interesting sense than we have yet realized.

Anne Loft's historical study of cost accounting in Britain captures nicely the political resonances of quantitative objectivity. Cost accounting first became important in Britain during World War I. The mobilization of the economy upset private markets, especially for items needed by the military. How were prices to be determined? The government and industry might have simply negotiated a price. But a private agreement resting on no more authority than administrative judgement lacked credibility. An especially untrusting party was the trade unions, whose members, after all, were being asked to hold down wage demands in the national interest. They would have regarded price negotiations between the companies and Whitehall as an opportunity for collusion. They insisted on objective evidence that they were not sacrificing wages for the benefit of profiteers. So cost

accounting, rather a new and undeveloped technology, was mobilized during the war to establish quantitatively that manufacturers were taking only a small profit above their actual costs of production.²⁹ Any economist can give good arguments why cost plus profit is an inefficient way to run an economy. But in a situation of distrust it may be the most credible way to run a polity.³⁰

Modern scholars almost instinctively regard this kind of quantification as a ruse, and the poor workers as dupes. But our habitual suspicions may go too far. If the bureaucrats and industrialists had the power to do whatever they wanted, they would not have been obliged to seek refuge in quantitative rules. We are, after all, talking about public knowledge. Whenever such calculations are exposed to unfriendly eyes, deviations from standard practices can be noted, and the rules become genuinely constraining – though naturally they still leave some room for creative manipulation. The civil servants who are the heroes of this story had to let themselves be standardized by a quantitative protocol in order to minimize conflict and avoid stalemate. The authority of public bureaucrats and private contractors was suspect; the reaction of the trade unions clearly mattered. Since it was difficult, perhaps impossible, to coerce them, they had instead to be persuaded to acquiesce. What went on was not quite reasoned democratic discussion, but neither was it simple coercion or trickery. This is power not in Stalin's sense, but Foucault's. It constrained the administrators almost as much as it constrained the workers. Quantification provided authority, but this is authority as Barry Barnes defines it: not so much power plus legitimacy, but power minus discretion.³¹

It would be a radical mistake to suppose that quantification is inherently liberal. Those whose activities the accounts describe are almost necessarily represented as objects of manipulation, and the numbers support direct administrative intervention.³² Close surveillance of accounts can provide the basis for strict hierarchical control of those who prepare the accounts, and early modern bureaucracies in France and England developed, almost simultaneously, elaborate mechanisms to limit chicanery. Prominent among them was the requirement that clerks keep detailed diaries, to be filled in on every line and signed by a superior at the bottom of each page, with a strict ban on emendations and erasures.³³ But such detailed mechanisms of control pertain rather to book-keeping than to accounting, which, like statistics, is less a matter of raw information than of standard ways to summarize and evaluate masses of numbers. As Peter Miller

and Nikolas Rose point out, accounting is in important ways typical of the exercise of power in modern liberal societies, especially through the channels of bureaucracy. It is not mainly an agency of direct, dictatorial power, but a set of methods and implicit standards, by which people are judged and by which they judge themselves. Subordinates are left with some autonomy, provided they maintain good numbers. Superiors are not supposed to intervene in the details, nor to impose forcefully their own discretion, but so far as possible to respect the objective measures.³⁴ This was the strategy developed by Donaldson Brown, a key player with Alfred Sloan in the invention of the modern, multidivisional corporation. He called it 'centralized control with decentralized responsibility'. His aim was to establish mechanisms by which the central office could maintain effective power without meddling in matters of detail that must inevitably be better understood at lower levels. His solution was to let the divisions manage their own affairs with a minimum of surveillance, so long as they maintained good numbers. 'Good numbers' meant something quite specific – an adequate 'return on investment', or ROI.³⁵ Canonization of an accounting category was thus integral to an influential style of management.

The Accounting Ideal in Science

The pressures and incentives by which accounting is shaped help to determine also the forms through which the authority and prestige of the natural sciences are enlisted by political and bureaucratic actors. It is time, though, to turn away from the explicitly political domain, to see what can be learned from the history and sociology of accounting about the uses of quantification within science. The point is not to reduce mathematically-expressed laws of physics, biology or chemistry to accounting conventions, but to notice how quantification serves as a distinctive style of communication, and promotes the formation of a certain type of scientific community. My object here is to use the perspective developed in literature on accounting to try to understand the role of quantification in statistical analyses and experimental reports.

The rediscovery of experimentation within studies of science has led to an enormous emphasis on the skills of the laboratory. It is widely argued that experimental skills are tacit and local. Many historians of science, and even more sociologists, are now inclined to

characterize science not in terms of public knowledge, but of private craft skills. I think the appreciation of tacit knowledge – Polanyi's insight – is right and valuable, but of course it is not by itself adequate as a basis for understanding science.

Some of the more discerning writers on experiment are already alert to this problem. One answer to it is networks, formed through personal contact, and promoting the spread of tacit techniques. This was long unduly neglected, and is now exaggerated. To allude to Steven Shapin and Simon Schaffer's study of experiment in seventeenth-century England, the air pump was for some decades a highly problematical and personal technology, but eventually it became something that any interested and moderately prosperous person could buy off the shelf.³⁶ Once such instruments begin to be mass produced, they promote greatly the pursuit of commensurable lines of research, if not the replication of results.³⁷ Similar, but of yet more general significance, is the armoury of machines and standards that make possible uniform measurement. The standardization of weights and measures has been crucial for reconciling and integrating the work of diverse laboratories. The historical problem of how these were defined and enforced has just recently become an important research topic, and it clearly deserves to be.³⁸ The activity of public bureaux of standards points to one of the ways in which theories contribute to the practice of experimenters, by providing a common language and often a rationale for choice of units. And very much, if not quite all, of this involves counting, measurement or other forms of quantification. The language of number deserves a prominent place among what Shapin calls 'literary technologies'.³⁹ Forms of rhetoric, as everyone recognizes now, are means of communication, and not just sneaky artifices of irrational persuasion. Quantification is a form of rhetoric that is especially effective for diffusing research findings to other laboratories, languages, countries and continents. The language of distrust is also a superb technology of distance.

Why should this be so? Why do numbers and calculation span continents, leap oceans, link laboratories, factories and governments? Part of the explanation is that mathematics is a highly structured language. It is a language of rules, the kind of language that even a thing as stupid as a computer can use.⁴⁰ Whenever a reasoning process can be made computable, we can be confident that we are dealing with something that has been universalized, with knowledge effectively detached from the individuality of its makers. This does not mean that mathematics is a neutral language, that

anything can be translated into mathematics, and thereby simply made more precise. Quantification is a powerful agency of standardization because it imposes some order on hazy thinking, but this depends on the licence it provides to leave out much of what is difficult or obscure. As nineteenth-century statisticians liked to point out, their science averaged away everything contingent, accidental, inexplicable or personal, and left only large-scale regularities.⁴¹ Similarly, the literary technologies of the modern scientific paper are inadequate to convey the tacit richness of experimental technique, or, for that matter, the arcane craft of formulating theories. For most purposes, such intimate knowledge is unnecessary. The value of superficiality has been argued by Peter Galison, who observes that the interactions among instrumentalists, experimentalists and theorists in physics are a bit like a trading zone, involving, say, European merchants and South American Indian craftsmen or farmers. All the meanings – religious, cosmological, ideological – are lost; the traders only need to agree on a price, a number or ratio. Similarly, it is often mainly predictions and measurements that pass between experimental and theoretical physicists.⁴² It may even facilitate easy communication if the rich craft techniques of both communities are simply ignored. This supports the more general point that Peter Dear makes in his contribution to this Symposium: namely, that objectivity has come to be distinguished first of all by what it leaves out, by the absence of subjectivity.⁴³

Nowhere in science is the preference for mechanical and objective reasoning over the communication of complex judgements more evident than in modern uses of statistical methods to analyze experimental and observational data. As in accounting, statistical rules are not simply arbitrary, but there is a strong element of the conventional. For example, the 5% and 1% significance levels have been canonized in various disciplines. This can be taken to rather absurd extremes, as in the case of the editor of a major psychological journal, mentioned by Gerd Gigerenzer, who revealed retrospectively his standards for accepting papers: 5% significance levels may be marginally acceptable for psychology in its current condition, but if psychology is to become really scientific, like physics, it must raise its standards and admit only conclusions vindicated at the 1% level.⁴⁴ This identification of quality with levels of statistical significance is silly. It is also impossible to justify the particular conventions of 5% and 1%. They must be understood as monuments to a scientific ethic of self-denial, as limits on what ambitious scientists can claim as

positive results. The American Psychological Association, calling upon experimenters to ignore results that approach but do not reach statistical significance, enjoined its readers as follows: 'Treat the result like an income tax return. Take what's coming to you, but no more'.⁴⁵ The conventions also provide standards by which researchers can compare one another's work without a lot of face-to-face discussion, often without real understanding. It is impossible to deny now the importance of tacit experimental skills for science. But, as Zeno Swijtink argues, there is a considerable premium in science on the objective and the mechanical, on replacing personal judgement and private wisdom with public standards and formal knowledge.⁴⁶ That is, science enshrines objectivity, meaning (here) not truth to nature, but impersonality, standardization – reducing subjectivity to a minimum.

This in turn has to do with the ethics of the scientific community, and gets us into what Lorraine Daston, most recently, has called the moral economy of science.⁴⁷ One of the remarkable, and much envied, achievements of modern science is the ability of scientists to achieve something like consensus. But this did not simply come naturally once scientists began experimenting and calculating. It was an achievement. It resulted partly from the adoption of standard techniques, instruments and modes of communication. These required an intense social discipline, so that, as E. Walter Maunder wrote in 1900, the ideal observatory became like a Whitehall office, keeping accounts of stars rather than income tax schedules.⁴⁸ It came also from agreeing, tacitly, to limit attention to what could be brought under good experimental control. From sometime around 1650 or 1700, science increasingly turned away from remarkable reports, rare events and mysterious happenings out in the world, focusing its attention ever more strictly on phenomena inside the laboratory, or often simply on paper, that through refinements of art had been made to behave themselves.⁴⁹ This of course did not solve the problem of replication entirely, but it made it much more promising that, with the help of a minute description and maybe also some face-to-face discussion, similar phenomena could be transported to other laboratories and revealed to other experimenters. Of course, scientists rarely replicate results for the sake of replication. They try to build on them, to incorporate them into other research programmes. But even this depends on an ability to move techniques and knowledge from one location to another. Every scientific result begins its career as a view from somewhere – say some particular laboratory – and it is

really the most fundamental task of every scientist to transform as much as possible into a view from nowhere, at least nowhere in particular.⁵⁰

Some decades ago, Merton identified organized scepticism as one of the basic ethical principles regulating the scientific community, and its relations to the larger political order.⁵¹ We need to reinterpret this a little. It isn't that scientists are fundamentally lacking in trust, nor that they tend strongly to iconoclasm. The relevant point is just that they are professionally engaged in research, and tend often not to be very interested in what they can't put to use in their own work. It is mainly on this account that personal authority by itself does not count for much in workaday science. Like every community, the scientific one depends on being able to get beyond the merely personal. Relatively rigid standards for reporting results, including the quantification of almost everything possible, serve science well in this regard. They were invaluable in creating a unified research community spread over much of the world.

The scepticism of the scientific community is not quite identical to the suspiciousness and subversiveness faced continuously by accountants, but the effect is at least similar. It means that writers are effectively placed at a considerable distance from their readers, and gives them reason to prefer objective – that is mechanical, often quantitative – forms over explicit judgments and an allusive, personal, intimate sort of communication. This goes a long way towards explaining why scientific style is generally more important than scientific content for creating knowledge that is useable in a contentious, macropolitical setting. The premier examples of this are, of course, accounting and statistics, perhaps the most powerful of all forms of knowledge extant, when observed from the standpoint of the political realm. In a sense, science is a prototype of the modern suspicious, pluralist, democratic political order. The organized scepticism of the research community demands formalization and objectivity in a way that is analogous, though of course not identical, to the systems of rules favoured by bureaucracies in modern western societies. The perspective from accounting studies suggests that the social history of objectivity is a political history too, and opens up new perspectives from which the history of modern science can be related to other aspects of society, politics and culture.

● NOTES

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1. Yuji Ijiri and Robert K. Jaedicke, 'Reliability and Objectivity of Accounting Measurements', *Accounting Review*, Vol. 41 (1986), 474–83, at 477. This is the formula for statistical variance, taken over measures of the same entity by different measurers. It is intended as an inverse measure: greater agreement among measurers implies lower variance, and hence (by definition) more objectivity.

2. Wiebe Bijker, Thomas Hughes and Trevor Pinch (eds), *The Social Construction of Technological Systems* (Cambridge, MA: MIT Press, 1987); Malcolm Ashmore, Michael Mulkay and Trevor Pinch, *Health and Efficiency: A Sociology of Health Economics* (Milton Keynes, Bucks.: Open University Press, 1989); Roger Smith and Brian Wynne (eds), *Expert Evidence: Interpreting Science in the Law* (London: Routledge, 1989).

3. James Secord, 'Nature's Fancy: Charles Darwin and the Breeding of Pigeons', *Isis*, Vol. 72 (1981), 163–86.

4. C. Edward Arrington and Jere R. Francis, 'Letting the Chat Out of the Bag: Deconstruction, Privilege, and Accounting Research', *Accounting, Organizations, and Society*, Vol. 14 (1989), 1–25.

5. David Chioni Moore, 'Accounting on Trial: The Critical Legal Studies Movement and its Lessons for Radical Accounting', *Accounting, Organizations, and Society*, Vol. 16 (1991), 763–91, who, however, argues that the critical accountants have not pressed their case hard enough.

6. This generally reflects no great trust in accountants, but rather a confusion between accounting and mere book-keeping.

7. On the uses and authority of accounting in general, see Stuart Burchell et al., 'The Roles of Accounting in Organizations and Society', *Accounting, Organizations, and Society*, Vol. 5 (1980), 5–27, and various papers in Anthony Hopwood, *Accounting from the Outside: Collected Papers* (New York: Garland, 1988). For a recent introduction to the history of accounting, see Peter Miller, Trevor Hopper and Richard Laughlin, 'The New Accounting History: An Introduction', *Accounting, Organizations, and Society*, Vol. 16 (1991), 395–403.

8. 'Ontologically, mainstream accounting research is dominated by a belief in physical realism', writes a recent critic, with some exaggeration, in the leading American accounting journal: Wai Fong Chua, 'Radical Developments in Accounting Thought', *Accounting Review*, Vol. 61 (1986), 601–32, at 606.

9. For a fine account of the effort to create and defend standards against the perpetual subversion of creative self-interest, see William Cronon, *Nature's Metropolis: Chicago and the Great West* (New York: Norton, 1991), Chapter 3. He discusses here the standardized grading of grain, which ultimately made it possible for traders in Chicago or London to buy and sell products they had never seen, and never would. Obviously this depended on creating a corps of reliable graders and inspectors. But the great enemy was elevator operators, who learned to dilute grain to the bottom of the grade, and farmers, whose complaints about such dealings endangered the whole system.

10. Bruno Latour and Steve Woolgar, *Laboratory Life: The Construction of Scientific Facts* (Princeton, NJ: Princeton University Press, 1986), 237.

11. Eric Flamholtz, 'The Process of Measurement in Managerial Accounting: A Psycho-Technical Systems Perspective', *Accounting, Organizations, and Society*, Vol. 5 (1980), 31–42.

12. Quotes from H.E. Arnett, 'What Does "Objectivity" Mean to Accountants?', *Journal of Accountancy*, Vol. 11 (May 1961), 63–68.

13. Harold Bierman, 'Measurement and Accounting', *Accounting Review*, Vol. 38 (1963), 501–07, at 505–06.

14. R.J. Chambers, 'Measurement and Objectivity in Accounting', *Accounting Review*, Vol. 39 (1964), 264–74, at 268.

15. Edward J. Burke, 'Objectivity and Accounting', *Accounting Review*, Vol. 39 (1964), 837–49, at 842.

16. Paul J. Miranti, Jr., *Accountancy Comes of Age: The Development of an American Profession, 1886–1940* (Chapel Hill, NC: University of North Carolina Press, 1990), 4–5, 128–42.

17. John W. Wagner, 'Defining Objectivity in Accounting', *Accounting Review*, Vol. 40 (1965), 599–605, at 600, 605.

18. H.T. Johnson and R.S. Kaplan, *Relevance Lost: The Rise and Fall of Management Accounting* (Boston, MA: Harvard Business School Press, 1987), Chapter 6. Some blame remains, to be laid at the door of accounting professors.

19. Don Lavoie, 'The Accounting of Interpretations and the Interpretation of Accounts', *Accounting, Organizations, and Society*, Vol. 12 (1987), 579–604, is highly critical of accounting positivism, as are Shahid L. Ansari and John J. McDonough, 'Intersubjectivity – The Challenge and Opportunity for Accounting', *ibid.*, Vol. 5 (1980), 129–42. But the need for accountants to interpret their numbers, which can often be misleading, was urged, largely to no avail, by some of the most influential figures in American accounting during what can plausibly be regarded as its formative period, the 1930s and 1940s. See remarks by George O. May (1938) and Walter Wilcox (1941) printed in Stephen A. Zeff (ed.), *Accounting Principles through the Years: The Views of Professional and Academic Leaders* (New York: Garland, 1982), 2, 96, 99, 101.

20. Ijiri & Jaedicke, *op. cit.* note 1, 476, 474.

21. Robert H. Ashton, 'Objectivity of Accounting Measures: A Multirule–Multimeasurer Approach', *Accounting Review*, Vol. 52 (1977), 567–75, at 567; also James E. Parker, 'Testing Comparability and Objectivity of Exit Value Accounting', *ibid.*, Vol. 50 (1975), 512–24. Both of these show that the objectivity debates continued to centre around discussion of the advantages of financial accounting according to costs *versus* various measures of present value.

22. Joseph F. Wojdak, 'Levels of Objectivity in the Accounting Process', *Accounting Review*, Vol. 45 (1970), 88–97, at 97. On the theme of interchangeable observers and the neutralizing of individuality in science see Lorraine Daston and Peter Galison, 'The Image of Objectivity', *Representations*, forthcoming; also Daston's contribution to this Symposium, 'Objectivity and the Escape from Perspective', *Social Studies of Science*, Vol. 22 (1992), 597–618.

23. John A. Zeff, 'Some Junctures in the Evolution of the Process of Establishing Accounting Principles in the USA: 1918–1972', *Accounting Review*, Vol. 59 (1984), 447–68, at 466; Arthur L. Thomas, *The Allocation Problem in Financial Accounting Theory*, *Studies in Accounting Research*, No. 3 (Evanston, IL: American Accounting Association, 1969), 100; Miranti, *op. cit.* note 16.

24. Ashton, op. cit. note 21.

25. Federal Inter-Agency River Basin Committee, Subcommittee on Benefits and Costs, *Proposed Practices for Economic Analysis of River Basin Projects* (Washington, DC: United States Government Publications Office, 1950).

26. Witold Kula, *Measures and Men*, trans. Richard Szepter (Princeton, NJ: Princeton University Press, 1986); Theodore M. Porter, 'Objectivity as Standardization: The Rhetoric of Impersonality in Measurement, Statistics, and Cost-Benefit Analysis', *Annals of Scholarship*, Vol. 9 (1992), in press.

27. Alfred Chandler, Jr, *The Visible Hand: The Managerial Revolution in American Business* (Cambridge, MA: Harvard University Press, 1977), 267–69, 273–81; H. Thomas Johnson, 'Toward a New Understanding of Nineteenth-Century Cost Accounting', *Accounting Review*, Vol. 56 (1981), 510–18; Johnson & Kaplan, op. cit. note 18.

28. R.H. Parker, *The Development of the Accountancy Profession in Britain in the Early Twentieth Century* (London: The Academy of Accounting Historians, 1986); Edgar Jones, *Accountancy and the British Economy, 1840–1980* (London: B.T. Batsford, 1981).

29. Anne Loft, 'Towards a Critical Understanding of Accounting: The Case of Cost Accounting in the UK, 1914–1925', *Accounting, Organizations, and Society*, Vol. 12 (1987), 235–65. For a similar story, later in the century, see Stuart Burchell, Colin Clubb and Anthony Hopwood, 'Accounting in its Social Context: Towards a History of Value Added in the United Kingdom', *ibid.*, Vol. 10 (1985), 381–413.

30. See Michael Power, 'After Calculation? Reflections on Critique of Economic Reason by André Gorz', *Accounting, Organizations, and Society*, forthcoming.

31. Barry Barnes, 'On Authority and its Relation to Power', in John Law (ed.), *Power, Action, and Belief: A New Sociology of Science* (London: Routledge & Kegan Paul, 1986), 180–95.

32. Trevor Hopper and Peter Armstrong, 'Cost Accounting, Controlling Labour and the Rise of Conglomerates', *Accounting, Organizations, and Society*, Vol. 16 (1991), 405–38.

33. See John Brewer, *The Sinews of Power: War, Money and the English State* (Cambridge, MA: Harvard University Press, 1988), 109; Peter Miller, 'On the Interrelations between Accounting and the State', *Accounting, Organizations, and Society*, Vol. 15 (1990), 315–38.

34. Peter Miller and Nikolas Rose, 'Governing Economic Life', *Economy and Society*, Vol. 19 (1990), 1–31; Miller and Ted O'Leary, 'Accounting and the Construction of the Governable Person', *Accounting, Organizations, and Society*, Vol. 12 (1987), 235–65; Rose, 'Governing by Numbers: Figuring out Democracy', *ibid.*, Vol. 16 (1991), 673–92.

35. Donaldson Brown, *Centralized Control with Decentralized Responsibility* (New York: American Management Association, 1927).

36. Steven Shapin and Simon Schaffer, *Leviathan and the Air Pump* (Princeton, NJ: Princeton University Press, 1985). See also Simon Schaffer's paper, 'A Manufactory of Ohms', on the Cavendish Laboratory and the definition of the ohm, given at a UCLA Tech-Know workshop (December 1989); and Bruno Latour, *Science in Action* (Cambridge, MA: Harvard University Press, 1987).

37. On the rich variety of ways in which instruments can solidify scientific networks, and connect them with a larger culture, see M. Norton Wise, 'Mediating Machines', *Science in Context*, Vol. 2 (1988), 81–117.

38. David Cahan, *An Institute for an Empire* (Cambridge: Cambridge University Press, 1989); Crosbie Smith and M. Norton Wise, *Energy and Empire: A Biographical Study of Lord Kelvin* (Cambridge: Cambridge University Press, 1989).

39. Steven Shapin: 'Pump and Circumstance: Robert Boyle's Literary Technologies', *Social Studies of Science*, Vol. 14 (1984), 481–520; Peter Dear, 'Totius in verba: The Rhetorical Constitution of Authority in the Early Royal Society', *Isis*, Vol. 76 (1985), 145–61.

40. Theodore M. Porter, 'Objectivity and Authority: How French Engineers Reduced Public Utility to Numbers', *Poetics Today*, Vol. 12 (1991), 245–65.

41. Theodore M. Porter, *The Rise of Statistical Thinking, 1820–1900* (Princeton, NJ: Princeton University Press, 1986).

42. Peter Galison, 'In the Trading Zone', paper given at UCLA Tech-Know Workshop (December 1989).

43. Peter Dear, 'From Truth to Disinterestedness in the Seventeenth Century', *Social Studies of Science*, Vol. 22 (1992), 619–31.

44. Gerd Gigerenzer and David J. Murray, *Cognition as Intuitive Statistics* (Hillsdale, NJ: Lawrence Erlbaum Associates, 1987), 23.

45. From the publication manual of the American Psychological Association, second edition, 1958, quoted in Gerd Gigerenzer, 'The Superego, the Ego, and the Id in Statistical Reasoning', in G. Keren and C. Lewis (eds), *Methodological and Quantitative Issues in the Analysis of Psychological Data* (Hillsdale, NJ: Erlbaum, forthcoming).

46. Zeno Swijtink, 'The Objectification of Observation: Measurement and Statistical Method in the Nineteenth Century', in Lorenz Krüger, Lorraine Daston and Michael Heidelberger (eds), *The Probabilistic Revolution, Vol. 1: Ideas in History* (Cambridge, MA: MIT Press, 1987), 261–85.

47. Lorraine Daston, 'The Moral Economy of Science', Critical Problems conference, Madison, Wisconsin (October 1991). I learn from Peter Dear that Steven Shapin used this phrase in the title of a talk in 1987.

48. Cited in Simon Schaffer, 'Astronomers Mark Time: Discipline and the Personal Equation', *Science in Context*, Vol. 2 (1988), 115–45, at 120; for other accounting analogies, see 129.

49. See Lorraine Daston, 'The Cold Light of Facts and the Facts of Cold Light', paper at UCLA Tech-Know Workshop (February 1990).

50. The phrase comes from Thomas Nagel, *The View from Nowhere* (New York: Oxford University Press, 1986).

51. Robert Merton, 'Science and Technology in a Democratic Order' (1942), reprinted as 'The Normative Structure of Science', in Merton, *The Sociology of Science: Theoretical and Empirical Investigations* (Chicago, IL: The University of Chicago Press, 1973), 267–78.

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