

## CRITICAL NOTICE

### Ideology, inquiry, and antiquity: a critical notice of Lloyd's *The Ideals of Inquiry: An Ancient History*

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A discussion of Lloyd's Turner Lectures at Trinity College. The importance of Lloyd's previous scholarship is characterized and these sweeping, erudite lectures are placed in the context of that scholarship. In the broadest terms, the lectures are a call to culturally and historically comparative study of human reasoning. At their heart is a comparative history of scientific theorizing from the ancients through to modern science. Lloyd rejects the positivist picture, and the view of modern and ancient science as discontinuous; he urges scholars to undertake comparative work on the ancient sciences in different traditions. This critical notice evaluates Lloyd's view and raises several questions for further reflection.

**Keywords:** ancient science; historical and cultural context of scientific theories; heuristics versus deduction

In recent years, G. E. R. Lloyd – surely one of the most eminent scholars of ancient Greek science – has been urging specialists in the ancient sciences to step beyond disciplinary boundaries and undertake comparative work on different ancient traditions:

We have to find out, as best we can, difficult though it is, what happened *elsewhere*, since it is only if we do so, that we can test our own ideas about why things turned out in the way they did in our primary target culture. I take it that we are all tempted, from time to time, to assume that developments more or less *had* to occur in the way they *did* occur in the culture we are used to . . . (Lloyd 2004, 10)

Although historians have internalized the challenge to positivism and are now 'alive to the twin dangers of anachronism and teleology' (Lloyd 2004, 9), Lloyd has argued that comparative study of different traditions is necessary to overcome deeper intellectual blind spots.

Lloyd is going against the tide here. So much of the movement in ancient science scholarship of recent decades has been away from ideologically outdated 'big picture' narratives, to the kind of detailed reconsideration that was sorely needed. Lloyd certainly rejects those outdated narratives, but he proposes that we are in a position to begin afresh with comparative work. The lectures in this book

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are less a call to arms than a presentation, to an interdisciplinary audience, of some successes of the research programme he has been urging.

Although few would deny the need for such comparative study, this challenge is a difficult one for most scholars to answer, and it is worth recalling the reasons why.<sup>2</sup> Study of the ancient sciences is hampered by several factors. Like the study of other aspects of antiquity, there is the problem of inadequate information, combined with the need for imaginative sensitivity to differences in the worldviews of those whose records have lasted a couple of millennia. But work on the ancient sciences further requires not only considerable historical–philological skills, but often also some degree of technical–scientific background. These two kinds of training – and interest – traditionally lie on different sides of the ‘two cultures’ divide. Institutional support is also thin. Few academic positions exist for this specialty, and experts tend to be scattered across the disciplinary map. In ancient Greek science – the one branch with which I am personally acquainted – there are a smattering of specialists with positions in departments of classics, philosophy, history of science or the natural sciences; they may have cross-disciplinary academic appointments, or none at all.

Lloyd’s seminal work has contributed much to increasing interest in the connections between the ancient Greek sciences and natural philosophy, but experts are still few. The situation is hardly better in the other ancient sciences Lloyd includes in his study: Mesopotamian, Indian and Chinese. The task of mastering the languages required to do comparative work here, as Lloyd has done with Chinese, is daunting. However justified Lloyd’s call for comparative work may be, reluctance to attempt it is surely not just intellectual timidity.

Professor Sir Geoffrey Lloyd is a prolific scholar: his pioneering work since the 1960s helped inspire new interest, particularly amongst scholars of ancient Greek philosophy, in the early history of the natural sciences and their interactions with natural philosophy and inquiries into method. At the same time, he has been instrumental in bringing new approaches and commitments from modern history of science to bear on the study of the ancient Greek sciences. If we look back at the early histories of ancient Greek science from the early twentieth century, we see how much the field has changed. From the former focus on discoveries and anticipations, there is now a broader attention to institutional environments and the *practices* of investigation. Since 1987, Lloyd has expanded his field from detailed studies of issues in ancient Greek science into comparative work on the histories of medicine in ancient Greece and China in particular.<sup>3</sup> He has written thoughtfully on the limitations and difficulties of such comparative work.

Lloyd’s current book has an even broader agenda: the history of human reasoning itself. Recently, he has been engaging with interdisciplinary studies that question whether our very perception and organization of the world is culturally mediated: to what degree ideas about colour, space, the self and emotions have universal features, and to what degree culture and language impact our most basic categories for organizing the world (Lloyd 2007). What Lloyd

attempts in *The Ideals of Inquiry* is much more than merely (merely!) a cross-cultural comparison of the practices of scientific inquiry in four different civilizations: he engages with issues in the history and philosophy of science, anthropology, the sociology of modernity, linguistics, evolutionary and experimental psychology.

All three strata of Lloyd's previous studies are reflected in *The Ideals of Inquiry*. Lloyd credits the community of scholarship at Cambridge for fostering this kind of interdisciplinary experiment (4–5); references to the pioneering work of colleagues pepper the narrative. Trinity College's Turner Lectures, which aim to address interdisciplinarity and the philosophy of the sciences, are an apt venue for sketching a vision of a cross-cultural research programme that centres on the ancient sciences, but situates these studies within an even larger programme.

The immediacy and exploratory atmosphere of a lecture series makes for good reading. In formulating research questions, Lloyd begins with the tradition with which he is most familiar, referring outwards from this basis to comparable controversies in other traditions. At times the very ambition of the work threatens to crowd out the possibility of thorough comparisons, and stretches the reader's ability to see the forest for the trees. That is, of course, the hazard of research at this level of generality. It is not a book aiming to satisfy all readers, nor to offer a final answer on its research questions. The narrative reflects its origins as a lecture series: this is no finished treatise, and specialists will likely prefer the more detailed consideration of some of these topics that Lloyd has offered elsewhere.

On the other hand, in a field where the confident histories of an earlier era have been set aside, there is need for a new vision. By offering such a broad perspective on the nature of inquiry as a human activity, and its relationship to the historical culture in which it is located, Lloyd's ideas will serve as an important foil against which subsequent scholars can formulate and refine more detailed studies. Very few would attempt synthetic work at this level of generality. It is a remarkable undertaking.

### **The four theses**

Lloyd has a broad agenda, and it must be acknowledged that this book does not offer much of a road map to those unfamiliar with the field. Despite its accessible tone, much background is assumed. The first four chapters take up particular topics, with only passing reference to the intellectual background that gives form to these inquiries. It is only in the fifth and final chapters – which break down all boundaries and address the history of human reason itself – that we find a clear articulation of Lloyd's target. I will begin there.

At the end of Chapter 5, Lloyd elaborates on his stalking horse throughout: an 'antiquated positivist view' which he summarizes in four theses (136). The first concerns a split between ancients and moderns. The idea that we can speak of 'primitive mentalities' or 'pre-logical thinking' is, he thinks, belied by the results of detailed studies of the ancient sciences, of the kind he has been undertaking.

The second is that the progress of ancient science was hampered by ideology; the third, related thesis is that the ancient Greeks constituted something of an exception to the second thesis. The fourth thesis concerns the idea of a scientific revolution and the view that it is only with the sixteenth and seventeenth centuries that exponential growth occurred in the modern sciences.

In including the fourth thesis – the idea that the scientific revolution constituted a radical break in the history of science – Lloyd acknowledges his long allegiance to what has been a major research programme in the history of science of the last few decades. That research programme aimed at recognizing continuities and pluralities in the history of science – replacing an older, simplistic dichotomy of ancient and modern – at the same time as it drew attention to the importance of social, economic and political factors in shaping the history of the sciences. The fourth thesis about the ‘Sci. Rev.’ is only tangentially Lloyd’s subject in this book, to the extent that he is concerned to emphasize continuities in the traditions of inquiry in antiquity with the modern sciences, and because of the ‘Needham question’ as to why China did not experience a similar revolution (129). But it is helpful to piecing together the larger theoretical agenda that informs his particular studies.

The ‘strong programme’ in the history of science in recent decades has been to show the degree to which social, political, economic and institutional factors influence decision-making and theory choice in the modern sciences. Lloyd has been instrumental in bringing this sensitivity to the study of ancient Greek science; he echoes many of its themes in this book. He focuses on institutional contexts and the impact of social and political factors on styles of scientific inquiry; he emphasizes the plurality of research styles in the various sciences; he eschews old-style history, which celebrates the anticipation of modern theories. ‘Externalist’ pressures and influences are emphasized over the ‘internalist’ logic of ideas.

Of the four theses under question, inclusion of the first is also a nod to a larger agenda, one that seems to be in its early stages in Lloyd’s thought. The thesis about ‘primitive’ thinking originated with the contrast between pre-literate and literate societies, in the work of anthropologists of the school of Levi-Strauss. This too is not really Lloyd’s main topic in these lectures, since the central comparative studies focus on the sciences in four literate societies. His ventures into this territory are somewhat tentative: Lloyd disclaims expertise at a couple of points. However, he is clearly interested in drawing on resources that would help understand the nature of human reasoning itself and the role that the study of human pre-history will play in that narrative. While he questions the ‘primitive mentality’ hypothesis of earlier anthropologists, Lloyd considers ideas from more sophisticated recent studies postulating the social origins of reasoning during the Pleistocene period, as well as from experimental studies of common patterns of reasoning.

Lloyd sees commonalities between attempts to understand the ecology of human reasoning, and his historical and comparative investigation into early

scientific texts. The parallel seems to be based on the notion that human reasoning does not need to be seen as tracking truth to be effective. We have as a species a number of tendencies to fallacious inferences, such as confirmation biases and other well-documented patterns of error (119). Although Lloyd does not spell this out, these new theories and experimental data seem to support his project because they suggest that we can separate the social role of certain practices of reasoning from their ability to give us accurate information about the world. Practices of inquiry should not be approached merely by considering their accuracy in reporting the world.

Most of the book consists of detailed studies of the methods, ideals and self-understandings of the sciences of the four ancient cultures under scrutiny: Greece, China, India and Mesopotamia. Here the second and third of Lloyd's four theses are surely the most germane. The idea that ancient science was hampered by political ideology and other forms of dogma would, on the 'antiquated positivist view', be the corollary of the notion that the scientific revolution changed all that for the modern sciences. If we are to extrapolate a core project for the book, it might be the examination of the ways that ideology played out in the styles of inquiry practiced in various ancient contexts, without assuming that the ancient Greeks constituted an exception. The implicit conclusion, as I understand it, is that there is no one single summary statement that can be used to characterize the ancient sciences, comparable to the discarded thesis that ancient science floundered in ideology. Lloyd's studies also indicate that he does not view the ancient Greek experience as fundamentally different from that of other traditions.

The dichotomies between ancient and modern, ancient Greek and 'other', are in question throughout the book. A fifth thesis that Lloyd *might* have added alongside the four is that the investigation of the natural world is different in kind from other fields of systematic inquiry. Lloyd compares various practices of reasoning, and looks at the development of method in different kinds of ancient inquiry: his topic is the history of reasoned inquiry, not simply the history of science. Yet in the end, he does not abandon the idea that there is something distinctive about those forms of inquiry that aim to be responsive to the natural world.

### **Audiences, experts and demonstrations**

Two of Lloyd's commitments are in play in the first chapter: to an 'externalist' approach to the history of science, and to questioning the adulation of ancient Greek science over other traditions of inquiry. The study concerns the relationship between a culture of democratic debate and the development of axiomatic-deductive proof styles. Lloyd opposes the valorization of deduction as a superior form of reasoning, as exemplified in the old complaint that Chinese mathematics was inferior to Greek because it had a practical focus and did not make use of a deductive style of proof (23). Lloyd mounts two simultaneous

critiques of this view: one shows the *perils* of an undue focus on the deductive, the other points to the political sources of the emphasis on ‘incontrovertibility’. He highlights the latter by contrast to the argumentative and social contexts of Chinese and Indian science, with their very different political contexts.

These complex themes continue past the first chapter. Some readers may prefer to approach this chapter after reading the second and third, which offer more detail on the theme of experts and audiences, and on the role of heuristics versus deductive styles of demonstration. There are many interwoven strands here. The announced question about the political inspiration for the idea of incontrovertible proof is straightforward enough: we can see it as at least partly a refinement and application of a familiar platitude among scholars of ancient Greek philosophy and science. It is often said that the political climate of the fifth- and fourth-century city states, especially Athens, played an important role in the development of techniques of argument, because of the societal importance of persuasion and evidence in its political and legal fora. Athenians *needed* to think about argument. Philosophy benefited because the need to persuade the *demos*, or to win a court case, forced a focus on argumentative technique.

To make the case that this environment fostered deductive-axiomatic proof styles, however, is a further step. In his previous comparative work on the Chinese and Greek traditions, Lloyd has been developing this theme. He argues that the agonistic style of participation in Greek society, which was especially marked in the democratic city states, had three consequences: the adoption of an adversarial style, a practice of challenging all accepted truths and the demand for objective demonstration of positions taken (Lloyd 1996, 216). The latter concern – ‘with certainty, with foundations, with axioms’ (Lloyd 1996, 221) – he takes to be behind the drive towards deductive demonstrations in ancient Greek science.

In *The Ideals of Inquiry*, however, the discussion ranges beyond this more focused question into broader concerns about the relationships between political authority, technical experts and public audiences. Furthermore, it is not always clear what kind of causal link Lloyd is chasing in considering the relationship between democracy and the preference for a deductive proof style. Lloyd concludes that Euclidean-style proofs are ‘democratic’, because they are independent of the status of the authority offering them, but also ‘anti-democratic’, because they were seen as superior to the merely persuasive power of actual political decision-making (17). This is, to say the least, enthymematic.

Socrates showed that even an untaught slave boy can follow a geometrical argument. This sort of demonstration would only be seen as supporting the institution of democracy, however, by those who think that the aim of political authority is to reason about what is best for us, and that the authority gained by persuasive reasoning in one field translates into expertise in another. Absent any such consensus, the anti-elitist implications of transparent proofs would speak only to the ability of scientific expertise to contest other kinds of claims to power. The ancient Greeks might equally have viewed mathematics as a kind of elaborate game, and sidelined its adepts with indulgent smiles.

The *anti-democratic* implications of deduction Lloyd proposes seem to have more to do with the personal history of one particular individual, however. To be sure, Plato tried to give political decisions the same degree of reliability as mathematical. In the aftermath of the shocking death of Socrates, the anti-democratic tendencies in Plato's thought can certainly be ascribed to a desire to assimilate all truth to the one kind non-experts could not take away from him. Yet surely deductive proof would be seen as 'anti-democratic' only by those already convinced that political reasoning is lacking by comparison, and, further, that someone offering to govern for us is the wiser because he/she has studied maths.

These questions about the rhetorical implications of the development of deductive styles of proofs seem somewhat orthogonal to the question whether a particular contestatory environment fostered attention to techniques of proof and standards of evidence. For Lloyd, the twin features of *competitiveness* and *elitism* distinguish the situation of ancient Greece from that of China and India, which did not valorize a comparable ideal of deductive proof (28). Lloyd sees an anxiety about the perils of democratic adjudication as central to the ideal of deductively certain knowledge developed by Plato and Aristotle (23).

Much depends on how we understand Aristotle's project here, since if his reasons for embracing this ideal of proof were simply different, it would be less clear how much we can infer from the idiosyncratic project pursued by Plato alone. Lloyd's (1996, 74–92) argument is spelled out in more detail elsewhere. Even so, there is room to wonder whether Aristotle's belief in the possibility of an axiomatized science had more to do with the successes of the *mathematica mixta* in applying mathematics to the natural world, and with his notion that the organizing taxonomies of the biological world could be arranged in an explanatory hierarchy. Aristotle is keenly aware of the limits of demonstration, and more alive to the differences of subject matter.<sup>4</sup>

Lloyd's attempt to show how political pressures fostered interest in deductive demonstration in one tradition but not in another is thought-provoking. He considers styles of reasoning as social products that responded to particular needs and demands, rather than as ways of approximating truth. It is important to acknowledge the difficulty of imaginatively stepping back from the internal logic of a practice like deductive proof and subjecting it to what Netz (1999; cf. Lloyd 1996, 227) called 'cognitive history'. Lloyd acknowledges that the pride of place ancient Greeks gave to deductive demonstration had its intellectual costs as well as a social payoff. His most intriguing idea in this regard is played out in the third chapter: that the ancient Greek emphasis on deduction was inhibiting because it led to the devaluation of heuristic techniques.

The theme of expertise and authority is continued in the second chapter, where Lloyd offers a taxonomy of styles of debate, which differ not only in the degree of formalization of the rules of engagement, but also in their ultimate purpose and in their notions as to who adjudicates. Here he focuses on the public *disputatio* rather than the kind of exchange that occurs between written authorities. Lloyd turns to the boundaries between medicine, astronomy and



divination for some of the most interesting records of debates about who counts as expert, and which kind of evidence is open to dispute.

Despite their distance from contemporary notions of procedure in scientific investigation, Lloyd notes some real value in these practices of public debate. Not only did contestation often produce self-awareness and reflection on method, it worked against the ossification of professionalized disciplines behind closed ranks of mutually validating experts. As a contemporary take-away lesson grounded in a historical sociology of knowledge, he suggests that it is not a bad thing for scientific experts to recognize an obligation to give public account of themselves (55).

### Methods in ancient sciences

Lloyd frames his inquiry in the third study in contrast to the outdated view that science progresses by accumulating data and organizing them into theories that are then subject to test against further data. The explosion of this Baconian picture of scientific progress, and the recognition that all data are already theory-laden, raises a question about the alternatives, or, as Lloyd disarmingly puts it, 'how ancient investigators got on' (56). A number of different topics fall under this umbrella: what techniques were developed, how idealizations and simplifications were deployed, to what degree ancient investigators were aware of the difficulties of empirical observation and the use of instruments.

One theme carries over from Chapter 1, where Lloyd suggested that the privileging of deductive styles of inquiry in the Greek tradition led to a devaluation of heuristic methods of investigation. Archimedes' *Method* is the key exhibit here: a solution involving an approximation was sidelined because of its non-deductive nature (28–29). The *Method* is a puzzling text, and one that has attracted more attention recently because the discovery of a palimpsest enables new readings of what was a poorly preserved text (Netz and Noel 2007). It considers a technique for finding the area of an irregular shape by thinking of slices of that shape of minimal width as comparable to weights placed in a balance. It is a thought-experiment in reconceptualizing a mathematical problem, using techniques from the field of practical mechanics. Lloyd's suggestion is that Archimedes rejected this kind of heuristic style of thinking because of his commitment to the ancient Greek preference for the certainty of deduction.<sup>5</sup>

This is a fascinating research question, and there is clearly much more to be explored here. For one, it would be useful to have a taxonomy of kinds of heuristics. It may make a difference whether we are discussing approximations for measurements that are merely practically difficult to make, as in Eratosthenes' estimation of distances in the course of calculating the size of the earth (71), or innovative stand-ins for quantities that we have no idea how to quantify. Other ancient Greek heuristic techniques that might have stood comparison to Archimedes' *Method* are the use of the amount of weight required to hold a load at rest as a place-holder for the amount of 'power' required to move



it with a lever, or Hero of Alexandria's concept of the balancing point of a sphere on an inclined plane as a way to consider what is keeping it at rest (Tybjerg 2004; Schiefsky 2008; Berryman 2009).

Lloyd's question is about the degree to which the preference for a deductive style of demonstration was inhibiting. Given Aristotle's articulation of the distinction between *presentation* and *discovery*, we might reasonably ask how many ancient Greek researchers shared Archimedes' qualms. How often did theorists – even those who credited geometry with a superior style – hold back from pursuing a less elegant or systematic investigative process? We might also wonder how often the adoption of the form of mathematical treatises in other disciplines was simply stylistic, as it sometimes seems to be for Hero of Alexandria.<sup>6</sup> Lloyd cites Galen and Proclus here (19), although the latter was not investigating the natural world, and the former hardly an exemplar of deductive reasoning.

Ancient Greek mechanics is sometimes said to encompass two quite distinct research programmes and styles. On the one hand are those like Archimedes who strove for mathematical simplicity and sought to unify fields as disparate as the theory of the balance and the study of hydrostatics. On the other hand, the practical and experimental methods of other mechanics seem to have predominated in the development of devices of various kinds. While the two camps were doubtless also in conversation, we see in the archaeological presentation of the different layers of the field of mechanics (104) how thoroughly it managed to develop in advance of theorization of its results, whether deductively presented or not.

We also find, in Philo of Byzantium, evidence of doubts about the attempt to unify mechanics under general and projectible mathematical truths (Berryman 2009, 128; cf. Gros 2006). We could see this tension in different lights: it might seem comparable to the tension between the lower status practitioner and the intellectually ambitious theorist who embellished his/her work by presenting it in a respected style of presentation, as in medicine. Alternatively, it could be a manifestation of the kind of strategy adopted by some optical theorists, reluctant to become embroiled in insoluble philosophical debates about the direction of travel in physical theories of vision (Berryman 2012). The attempt to integrate geometrical optics into a larger theoretical picture was simply an impediment, since 'it makes no difference' to the geometry of perspective what direction the physical theory assumed. This kind of insulation strategy might have proved useful in some stages of inquiry: Lloyd (2006, 208) notes that the disputatious style of Greek inquiry was sometimes inhibiting. In yet other contexts, there may be reasons to challenge the attempt to impose mathematical idealizations onto other fields of inquiry.

Lloyd explores some cases of idealization: the costs of abstraction from parallax in Greek astronomy (75ff.) and the approximations used in Chinese mathematical astronomy. The various treatment of friction, and the associated question whether this is legitimate – whether mathematical proportionalities

hold ‘all the way down’ or are limited by *minima* – would be another. The latter controversy would be a particularly rich vein to work, since it is an issue where the validity of idealizing and ignoring variables comes into question (Cuomo 2000; Gros 2006; Schiefsky 2008). Some posited the existence of lower limits as evidence of boundaries to the projectability of certain relationships, and ultimately as an argument for reasserting the viability of hylomorphism (Berryman 2009). In late classical antiquity, we find vestiges of a debate about the extent to which mechanics offered a general programme for studying the physical world or encountered limits to the applicability of mathematical rules to the natural world and reaffirmed the explanatory role of form. There were intellectually motivated reasons for resisting general claims based on idealization: for example, the evidence of chemical transformations of matter indicated its limitations to Plotinus, Simplicius and Philoponus (Sambursky 1962, 42–43; Berryman 2009).

In the context of debates about the void, Lloyd seems to suggest that adherents of a teleological programme were willing to ignore contrary evidence (91–92). This seems premature: there is evidence of continuum theorists acknowledging the possibility of a ‘potential void’ to accommodate the evidence from pneumatics (Sedley 1987). Lloyd does not distinguish here between the classic continuum notion that matter expands and contracts, and Ctesibius’ discovery in the third century BCE that it has *eutonia*, the capacity to rebound after deformation. Hero of Alexandria developed a new particle theory of matter to account for the apparent evidence that particles are elastic (Berryman 2010); third-century Stoic philosophers may have been recognizing the newly discovered elasticity of matter in their physics (Vegetti 1993; Berryman 2009). Insofar as this discussion of responses to pneumatic evidence constitutes the clearest data point Lloyd offers here on the question whether ancient Greek theorizing was driven by external ideological agendas, it merits more detailed argumentation.

Lloyd is persuaded by Sedley’s arguments concerning the ideological basis of the debate between ancient Greek continuum and atomist theories (91). It is, however, less than clear to what extent religious ideology informed Aristotle’s development of teleological theory. The question whether ancient science was driven by reason or ideology might be complicated in a context where certain notions of rationality seem to have been treated as an ideology or religion in their own right, and where notions of the divine were subject to philosophical revision. The factors involved in a school’s initial adoption of a theory may be different from those that permitted innovation and revision within philosophical schools (cf. Lloyd 1996, 37–38). Comparative work promises to shed more light on the institutional factors that encouraged innovation over conservatism.

Lloyd returns to a question whether ancient science can be characterized by the absence of experimentation. He justly notes that much use of trial-and-error in technology goes unsung, and was likely carried out by those uninterested in larger metaphysical questions. Especially important here is the quotation from Philo of Byzantium, cited in a different context (100), which witnesses to one of the most

systematic research programmes in ancient Greek science, namely, the search for a formula for the scaling up of ballistic devices from smaller prototypes once designs with optimal firing power had been developed.

Lloyd refers back to a theme he explored in earlier work: that what look to us like experiments were actually being cited as witnesses (85). He argued persuasively that case studies were often offered in the service of theory and not as genuine trials. As a criterion of true experimentation, however, Lloyd claims that what is missing in antiquity are trials conducted from a disengaged perspective (85). We are not told why such neutrality is necessary: why it is not enough that the experimenter be willing to embrace an outcome that is disappointing or unexpected, as with the Egyptian king Psammeticus' attempt to find out which human language is the oldest. As Herodotus reports this seventh-century BCE social science experiment, the king swallowed his disappointment that Egyptian was found not to be the oldest and accepted the evidence giving the palm to the Phrygians.<sup>7</sup>

What might be especially valuable in this regard is evidence of cultural or institutional practices that legitimate the possibility of changing one's mind or acknowledging previous error. Lloyd mentions the conservatism of some Chinese authorities, who rejected a proposed improvement in the armillary sphere (40). It is as important as ever today for us to understand the circumstances that support the practice of acknowledging mistakes or modifying one's views.

This problem of evidence applies to assessing our 'haul' of practical devices that resulted from ancient science (100). Confidence in the reliability of literary records was shaken by recent reconstructions of the Antikythera mechanism (100), a piece of physical evidence recovered from a shipwreck a century ago, but still today being examined by a team of experts. Ongoing efforts to reconstruct and date the device raise larger questions about the accuracy of our picture of the technology and science of the Hellenistic period, and have given rise to considerable speculation.

### **The uses of inquiry**

In the fourth study, 'Ontology and Values', Lloyd considers two disparate questions: what objects the ancient sciences were investigating, and what goals the ancients ascribed to their investigations. The former question is an opportunity to return to the topic of the ancient understanding of the relationship between mathematical descriptions and physical theories of the world. The latter question is especially worth asking in a context where the sciences had not, by and large, delivered significant practical benefits (98).

Whatever one's externalist commitments, it seems to put the cart backwards to place the desire of investigators for reputation and employment ahead of the perceived intrinsic merits of the inquiry, since it is only in a context where those inquiries are valued that they are likely to become routes for personal advancement. Lloyd is oddly dismissive of the claims of mechanics to usefulness

on the grounds that some of its branches are mere toys for entertainment (105): the political value of display pieces as symbols of power should not be discounted, and ancient notions of the useful may not be quite the same as ours. He stresses the differences between the Greeks and Chinese on the question whether understanding of the nature of the world was important because it contributed to personal happiness, or because it dignified the authority of the ruler (110–113).

Lloyd is, as he acknowledges, necessarily selective in his presentation of ancient modes of inquiry: he is sketching some large themes, rather than offering an exhaustive study. Whatever the scholarly temptation to quibble with counter-examples to some of his claims, there is no question about the importance and depth of the kind of inquiry he launches. While Lloyd (2006) does not turn his lens explicitly to the question of the usefulness of comparative studies of the history of ancient sciences here, he has argued elsewhere for the importance of highlighting the contexts that make possible the kinds of attitudes and approaches that underlie the notion of inquiry itself: ‘the really exciting and important questions to do with antiquity relate to how fundamental preconceptions get to be modified, assumptions to be challenged, how inquiry itself gets off the ground’ (207).

The humanistic study of scientific authority is sometimes mistakenly understood as an attack on its legitimacy: some of the more radical positions in the anti-positivist programme seem to question whether there is any subject to the investigation that is *not* socially constructed. Those investigating the institutional nature of scientific authority have needed to think their way out of positivist frameworks in order to better understand the ecology of practices of reasoning.

Lloyd ends, somewhat cryptically, with a plea for ‘balance’ (138). He wants both to acknowledge the specificity of the modern styles of research that characterize the modern sciences, without forfeiting the claim that the project of inquiry is one shared by all human beings and cultures. The universality of the capacity to inquire is not, he suggests, in conflict with the recognition that human reasoning manifested itself in very different practices in different times and places, and indeed in the very different techniques of different sciences, whether ancient or modern. But Lloyd seems to resist an even more radical challenge to the authority of the sciences based on the claim that they, unlike cultural forms, exhibit convergence because what is being studied is a single subject, however variously described, i.e. the natural world (136–137). Lloyd (1996, 210, 227) does not seem to be abandoning the hope that comparative studies would be illuminating because, in some sense, they are thought to be different ways of approaching some common aspect of the world. We might question the rationale for cross-cultural comparative work if all we have, in the end, are distinct cultural practices, each locked in its own impenetrable hermeneutic circle.

Here, it seems, is the tightrope he is most concerned to walk. Lloyd’s subject is still centrally the history of the sciences in contrast to, say, Aristotle’s *Poetics*; he still wants to define the ancient sciences as forms of *inquiry* that are framed as investigations of the world, and not of the things we say about it. Lloyd

acknowledges, if obliquely, that the inquiries he is studying ‘had to recognize further constraints from the side of what it was they were investigating’ (138). Against the background of the debates in specific quarters of contemporary academia, Lloyd seems to be acknowledging that the ancient sciences interact with something that is not entirely socially constructed. We might infer that such a plea for moderation is aimed at those who emphasize the societal and institutional causes of scientific modes of knowledge at the expense of recognizing their responsiveness to the world.

Lloyd’s closing remarks may signal that, for someone who has been at the forefront of bringing the new style of history of science to the study of the ancient sciences, the attack on the positivists has ‘been done’. In describing them as ‘antiquated’, Lloyd acknowledges that his thematic targets are often half a century old or more: the positivist history of science, the notion of a ‘primitive mentality’ and the ‘Greek miracle’ literature that privileged the achievements of one culture at the expense of others. That kind of time-lag might seem a lot in other, more populated fields; it may also say something about the current state of play in the study of the ancient sciences that so few alternative ‘big picture’ generalizations were offered in the interim.

These studies illustrate how comparative work can highlight *different* questions than the study of scientific cultures in isolation. The style of comparative work he advocates is emphatically not informed by notions of an ideal to be aspired to – ‘why *didn’t* China have scientific revolution, or antiquity an industrial one?’ – with their implied negative evaluations, but rather engages reflectively with the motivations and agendas of the various kinds of inquiries and tries to understand what questions moved *them*, and why. There may be an attendant danger that comparative studies would unduly focus on *differences* between traditions at the expense of commonalities. Yet no clearer picture can begin to emerge without risking some broad brush strokes.

Lloyd is urging scholars to undertake ‘big picture’ and cross-cultural accounts once again. These lectures do not attempt to be the last word on the questions he raises. In re-opening a number of larger conversations, he is likely to be taken as a starting point, for scholars brave enough to undertake this kind of project, for a long time to come.

### Disclosure statement

No potential conflict of interest was reported by the author.

### Notes

1. <http://www.philosophy.ubc.ca/>
2. Lloyd (2006) reflects on the challenges faced by the field, as well as the changes during his academic life at University of Cambridge.
3. See especially Lloyd (1996, 1–19); on page ix, he dates his conversion to the project of comparative study of the Greek and Chinese sciences.

4. Lloyd (1990) details Aristotle's engagement with proof in a context that is not informed by comparative work: an *agonistic* motivation is not apparent.
5. Cf. also Lloyd (1996, 51–52).
6. But cf. Tybjerg (2004) on the complex uses of proof in Hero.
7. *Histories* 2.2.

### Notes on contributor

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