

LANGUAGE, TRUTH AND REASON: 30 YEARS LATER

Ian Hacking

Abstract

Language, Truth and Reason, in M. Hollis and S. Lukes (eds.) *Rationality and Relativism* (Oxford: Blackwell, 1982): 48-66. 'Style' for Historians and Philosophers, *Studies in History and Philosophy of Science* 23 (1992): 1-20. Both reprinted in *Historical Ontology*.

The programme of LT&R has evolved over the years, but aside from (1992), progress reports were published only in obscure places. This talk will mention a few modifications and novelties. It will begin with trivia.

The 1992 paper was badly named. It is about 'style' for philosophers (not historians), making use of some traditional historiography. Second, the noun 'style' does not matter. At present I quite like 'styles of scientific thinking and doing in the European tradition', but 'methods of argument' or 'modes of inquiry' suit me fine. I most like 'ways of finding out', because this project is *one* approach to the question, of how we have found out how to find out, in what at present we call the sciences. And then the philosophy: what new ways of finding out have done to our language, our conceptions of truthfulness, and our notions of reason.

There is no question of providing a definition or demarcation 'a priori' of a 'style of scientific reasoning'. A handful of fundamentally distinct modes of inquiry have, as a matter of fact, developed in the sciences, and are in vigorous use today. A. C. Crombie usefully presented six of these at immense length.

I rely heavily on tradition. Thus Kant was right when in the preface to the second edition of the first *Critique* he distinguished two great 'intellectual revolutions' in human reason: the discovery of mathematical demonstration, and the discovery of the experimental method. These are better thought of not as revolutions but as crystallizations of a large family of mostly inchoate methods of argument and investigation. *Crystallization* is a new framework concept, to be added to the familiar roster of paradigms, research programmes, themata, *Denkstile*, *épistèmes* and so forth. It will be elucidated in this talk.

Francis Bacon foresaw, in his tale of ant, spider, and bee, the need of Kant's second crystallization. Experimental exploration collects like the ant. Hypothetical modelling builds elaborate structures out of its own substance, like the spider. We need the bee to combine both, and that bee (I argue) is the laboratory in which one builds apparatus to generate and explore new phenomena in accordance with hypothetical models. Hobbes saw the writing on the wall in his critique of Boyle: this was an absolutely new method which Hobbes (rightly) feared as changing our very notions of truth and evidence. Rather than pursuing crystallizations in Crombie's other styles of scientific thinking, the talk will conclude with a more nuanced account (than in 1982 and 1992) of what crystallizations do to truthfulness, objectivity, and ontology in the sciences. This part of the philosophical programme is heavily influenced by Bernard Williams' *Truth and Truthfulness* (2002).

Rasmus Winther

Styles, Models, and Paradigms: Three grammars of scientific theory and practice

How should we understand the units of theory and practice operative in science? Hacking and Crombie developed styles of scientific reasoning. Suppes, van Fraassen, and Cartwright articulated models. Fifty years ago, Kuhn gave us paradigms. Are these three grammars nested, do they cross-cut or are they perhaps in tension? Which commitments to realism, abstraction, and the ethico-political power context of science does each make? In this talk I will attempt a three-way comparison of styles, models, and paradigms. The goal is to explore these different proposed grammars of scientific theory and practice with an eye towards identifying their internal rules and assumptions, their respective conditions of interpretative application, and their mutual relations.

Taking a look at history

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In “Two Kinds of New Historicism” (1990), Ian Hacking speaks of the “Lockean Imperative”, which he defines as: “taking a look”. According to Hacking, Locke’s *Essay Concerning Human Understanding* is a non-historical work, which speaks, however, of the origins of ideas and the origins of knowledge. Hacking recommends that philosophy follows the empirical adage of taking a look at history, but does not endorse the view that tracing origins would solve philosophical problems. He suggests that philosophers study words in their historical sites in order to comprehend what the concepts were and how they became useful or problematic. He urges for the kind of philosophical analysis that would involve taking a look at history, but not in a grand manner. Rather, he speaks of local historicism which demands “taking a look at lots of little facts”. In that connection he mentions ethnographers, anthropologists and microsociologists who, inspired by Kuhn’s work, adduce lots of little facts about science and put historical substance on the “bare scaffolding” of philosophy.

Kuhn, who was largely responsible for the historical turn in philosophy of science and was mentioned by Hacking as his mentor, in his essay “The Trouble with the Historical Philosophy of Science” (1992), uses the same visual metaphor and says that recourse to history requires “no more than a glance”. Both Kuhn and Hacking, by speaking of merely glancing at or taking a look at history, refrain from attributing to it a more robust role. This is related, I think, to the problems that emerge from assuming that history can be seen as a repository of empirical facts, used most often as evidence for philosophical claims. It is feared, for instance, that hypotheses are underdetermined by evidence, that the connection with history may lead to relativism, that any attempt to overcome the divide between history and philosophy may lead to naturalistic and genetic fallacies. Hacking was also worried that the use of history in a grand manner may result in some example of the little admired speculative philosophy of history.

In the paper, I will concentrate on how history can team up with philosophy and will take up two examples discussed by Hacking. First, I will consider Locke, whom Hacking mentions, and I will show that, in his case at least, the relation between history and philosophy is a complicated one. Locke considered his *Essay* - a paradigmatic work of modern philosophy-, a *history* of the understanding which was composed by using the "Historical, Plain Method". This method was also responsible for producing Bacon's natural histories, which we now consider as falling under science, not history or philosophy. Secondly, I will compare the science studies practice, referred to by Hacking, of summoning "lots of little facts" from the history and practice of science, to Wittgenstein's summoning of facts from our natural history. In the Science Studies literature, the comparison with Wittgenstein has been taken to imply that philosophy ought to be replaced by ethnomethodology, which virtually reduces philosophical investigation to empirical research. I will argue that this was not the case with Wittgenstein nor was it the route recommended by Hacking. Wittgenstein assembled reminders, real and fictitious examples of linguistic usage, in order to show that meaning is not an entity attached to words but a matter of practice that may vary widely. In a similar manner, Hacking's taking a look at the history of science, or Kuhn's glance at history, may be taken to serve philosophical purposes, such as that of combating essentialism by displaying the variety of ways science has been practiced. This gesture towards history, however, is not, as Hacking put it, "to resign one's birthright to be a philosopher".

An ecological view of “style” of science

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Historian Alistair Crombie (in his *Styles of Scientific Thinking in the European Tradition*, 1994) used the term “style” in reference to the “cultural ecology” of a society: its views, convictions, and sacred cows, as well as its methods of problem-solving. In science, he identifies three clusters of convictions. The first consists of views about nature and its knowability. The second relates to science itself, the organization of inquiry, argument, and explanation. The third has to do with social conceptions of what is desirable and possible: the moral, scientific, and technical dimensions of human intervention in nature, and the tension between conservation and innovation.

Crombie said nothing about the origins of the term “style” as he used it. It seems likely, however, that there is a connection with the term “style of thought,” coined by the sociologist of knowledge Karl Mannheim. In the 1920s, Mannheim was just about the only scholar to use the term “style” in connection with anything but periods of art history. He was in search of something more fundamental than schools of thought. Schools of thought differ in that they make use of different theories, but the differences between styles of thought have to do with what Mannheim called the *Weltanschauungstotalität* (internal unity of a world view). Furthermore, each style of thought is associated with a different *seinsmäßige Beziehung* (existential relationship) to the objects of knowledge. Mannheim also used the compound word *Weltwollen* (will to the world) to make this point.

Reflecting on styles in art history, the first observation we might make is that such styles—Gothic and Baroque, for instance—are a collective matter. Individual artists form part of a collective tendency which provides them with a point of orientation. However unique their individual achievements may be, a certain style (distinguished from other styles by its conventions) guides their actions, as the art historian Erwin Panofsky has noted. Individual

representatives of that style have internalized the conventions in question. The French sociologist Pierre Bourdieu called a style of this kind a “habitus.”

However, the conception of a style as the embodiment of a collectivity is not free from the usual pitfalls. The art historian Ernst Gombrich was one critic of excessively holistic views that turn a style into an imaginary super-artist and consider this method a sure way of gaining insight into the mentality of a period. Looked at in this way, style and *Zeitgeist* are one and the same.

But this puts us in danger of throwing out the baby with the bathwater, namely, how to interpret the connection between different aspects of historical reality. We should note first that Gombrich’s own conception of style was more modest than Panofsky’s. Gombrich analyzed style as a notational system, thus emphasizing the activity of the artist as a maker of visual images. He approvingly quoted the art historian Heinrich Wölflin, who called art history the “history of seeing.” This view draws a link between style and an important aspect of Thomas Kuhn’s notion of a paradigm.

Kuhn’s paradigm concept has proved to be the most successful way of conceptualizing changes in science. Kuhn showed how, for instance, the transition from a Ptolemaic astronomical system to a Copernican one can be seen as a change in worldview. A new theory leads to a new image of reality. In this example, that not only meant that the sun replaced the earth as the center of the cosmos, but also that the Copernicans were open to seeing changes in the heavens, where their predecessors and opponents in the field of astronomy believed they saw only an ancient and unchanging universe. The similarity to style, in Gombrich’s representational sense, is striking. Theories are, as it were, different notational systems for reality, just as Impressionists and Cubists represent trees in a landscape in different ways. In both cases, the “truth” of the notation is bracketed.

But it is possible to expand on Kuhn’s analysis. At the time the new experimental style emerged, the status of scientific knowledge also changed substantially. Copernicans had not only a new scientific worldview, but also new aspirations for the cultural significance of that worldview. At the very least, we can conclude from this that a style involves more than just a mode of representation.

Crombie brings us closer to resolving this issue through the metaphor of a style as an ecology. According to the ecological view, a style is a whole composed of many heterogeneous parts. Art historian Michael Baxandall's concept of "cognitive style" embraces more than just modes of representation. To interpret an image, he says, you need categories, model patterns, and "habits of inference and analogy." Returning to Mannheim's conceptual model, we can see that the heterogeneity of scientific styles goes even further. Styles draw connections between the criteria for calling things true, rational, possible, desirable, acceptable, and plausible.

The essence of Mannheim's contribution can be captured by the word "ethics." Mannheim contested the "positivist prejudice" that we can free ourselves of metaphysical presuppositions and distinguish between facts and values. Every *Weltanschauungstotalität*, every style of thought, has its own way of connecting methodological and metaphysical assumptions.

Historical analysis of the six styles of science shows that each one involves certain metaphysical assumptions. Purely deductive thinking, for instance, involves optimism about the knowability of the cosmos, an optimism which stems from an assumed affinity between the cosmos and the human mind. Such optimism is entirely absent from the hypothetical-analogical style. Though deduction plays a central role in this style as well, the expectations about what it can accomplish are very different. Another example is the experimental style, which could not have developed without the "ethics" of *virtú* and the *vita activa*.

(Adapted from Chunglin Kwa, *Styles of Knowing: A New History of Science from Ancient times to the Present*, forthcoming with The University of Pittsburgh P

Styles of Scientific Thinking Can Kill

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Ian Hacking's philosophy of science of the last 20-30 years is dominated by the project of rethinking the entire structure of science via the notion of 'styles of scientific thinking.' A style of scientific thinking is a 'way of finding out about the world' characterised by: (1) the introduction of its own distinct class of objects, (2) new criteria for the truth or falsehood of statements about those objects, and (3) the property of being "self-authenticating", i.e. of bringing into play a method of reasoning that defines what it is to tell the truth in the relevant domain; consequently, (4) a style of scientific thinking determines what 'objectivity' consists in for its domain, as the only way to find out whether a sentence about that domain is true or false is by using the relevant style; finally (5), a given style of scientific thinking is not good because it is good at finding out the truth in some domain (since it itself sets the criteria for successful truth-telling it will always obtain maximum points on that score), and if it eventually does get replaced by another style it will not be for 'internal' reasons—e.g. failure to self-authenticate, or some other deficit in rationality or internal coherence—but 'external' ones, i.e. a failure of the cultural context to continue to provide the social conditions (institutions, etc.) necessary for its perseverance (Hacking 2009).

A crucial feature of this account of scientific reason is that it is explicitly genealogical, rather than analytical: scientific styles are said to be grounded in our (innate) cognitive capacities as well as in the history of civilisations and institutions, but they themselves have no 'essence' and any attempt at a precise definition of a style (including Hacking's previous own efforts) is bound to be 'misguided' and 'artificial.' Nor can or should we hope that the notion of a scientific style will yield a demarcation criterion: only when a given scientific style withers for (historically contingent) sociocultural reasons do we cease calling it 'scientific.' A. Crombie's list of 6 generic scientific styles of the European tradition is therefore not likely to be exhaustive, and Hacking's remarks on Williams 2002 as well as Chinese mathematics suggest that there might be other distinct scientific styles elsewhere, in European historiography as well as in non-European sciences.

I propose to test the consequences of Hacking's ideas by applying them to the South African context. The latter is characterised by strong and widespread scepticism about the value of scientific inquiry as practiced in the West and imported—as well as imposed on—the African continent. This scepticism is nourished, on the one hand, by Afro-centrism, a cultural movement and ideology according to which traditional indigenous African science and knowledge systems have been unfairly suppressed, downgraded, and denigrated during colonialist and apartheid times, an injustice that continues into the post-colonialist era. On the other, it is fed by the prevalence of various types of magical thinking—beliefs in muti and sangomas, superstition, spiritualism, extraordinary powers, and precognition—and its continued influence on the behaviour of South Africans at all levels of society. I argue that by Hacking's very unrestrictive characterisation of styles scientific thinking in terms of (1)-(5), African magical thinking amounts to a distinct African style of scientific thought.

This result is in itself value neutral, although it will be considered politically opportune and morally appealing by many—perhaps including Hacking himself. His doctrine of self-authenticating styles implies that there are no meta-standards by which to judge the statements sanctioned by a given style, and he notes with approval that it is hence impossible to judge those who operate in a given style as 'more rational' or 'better informed' than those who operate in another, or to judge someone as having more or less 'objective' or 'rational' conceptions than others (these judgements only make sense within, but not across, styles). I suggest that such a situation might not always be desirable, however: empirical evidence suggests that sceptical attitudes towards western science by policy makers as well as pervasive belief in traditional medicine by the general population in South Africa may have contributed to tragic consequences in connection with the HIV/AIDS epidemic.

Former South African president Thabo Mbeki—using post-colonial afro-centrist rhetoric—over a period of several years denied publicly that (Western) science had established a causal link between HIV and AIDS. In the meantime, several miracle cures developed by local “researchers” (working outside the Western style) were announced without proper testing, and ARV

uptake among those testing positive was at a mere 30%. This was, I argue, due in part to a cultural mode of transmission of information about the disease torn between African and European styles of scientific thought, as well as Mbeki's active promotion of scepticism about western science. The human cost was, according to one authoritative study, an estimated 365,000 preventable deaths. If it is correct that African medicine and Western medicine are tributaries of two distinct styles of scientific thinking, then recent South African history provides an illustration

how, under some circumstances, adherence to (the wrong) style can kill you.

This may not disprove Hacking's position that all styles are equally good, rational, or objective ways of finding out about the world, since each style defines what amounts to being "good", "rational", and "objective"—but it certainly provides strong prudential reasons to disbelieve it. I close by suggesting that there are two ways of fixing the problem: 1) provide more stringent (non-genealogical?) criteria for a style of scientific thinking, or 2) elucidate the slightly mysterious relationship between style independent statements and style-dependent ones, with a view to establishing a (realist, pragmatic, instrumental?) meta-standard of goodness of styles—though I fear that either approach would dilute the present French/Königsbergian flavour of Hacking's philosophy and place it in more dour Anglo-Saxon surroundings; a move not likely to find the favour of its author.

Truth contrary to fact: Fictional histories and virtual functions

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This essay focuses on Hacking's genealogical critique of "arch-rationalism." Arch-rationalism is the view that some "styles of reasoning" are better than others. By contrast, Hacking's "anarcho-rationalist" thesis holds that "[w]e cannot reason as to whether alternative systems of reasoning are better or worse than ours, because the propositions to which we reason get their sense

only from the method of reasoning employed.”¹ The arch-rationalist and the anarcho-rationalist can agree that distinct styles of reasoning emerge (or die out) at various points in history. But in Hacking’s view, the arch-rationalist fails to see that being true-or-false is a property of propositions only in virtue of styles of reasoning. There is no meta-reason which would ground normative comparisons of alternative styles of reasoning, save perhaps a meta-reason favoring a tolerant attitude toward a proliferation of new styles of reasoning.²

This essay will argue that there is at least one meta-reason to adjudicate among different styles of reasoning. A style of reasoning ought to specify as candidates for truth-or-falsehood those propositions which carry information relevant to the satisfaction of human needs, purposes, and desires. This claim draws on Bernard Williams’s account of the function of linguistic communication in *Truth and Truthfulness* (2002). With Williams, I suggest that the function of human language is to communicate useful information which is essential for the satisfaction of common human desires.³ Strictly speaking, Williams’s book is an account of *truthfulness*—that is, a commitment to telling the truth—rather than *truth*. However, I shall contend that Williams’s notion of truthfulness imposes normative constraints on all styles of reasoning. If the function of language is to communicate information which furthers human desires and aims, then one style of reasoning may be better than another insofar as it better contributes to the function of communicating useful information.

For Williams, truthfulness involves having dispositions to be accurate—to acquire and impart *correct* information.⁴ He offers a fictional genealogy to explain the value of accuracy as a *virtue of truth*. This genealogy clarifies the sense in which the function of language is to communicate useful information. Williams argues that accuracy is valuable because it contributes to the function of language. However, if dispositions to be accurate are to support this function, they must promote the acquisition of information relevant to the satisfaction of human purposes. I argue that different styles of reasoning, *qua*

¹ Ian Hacking, *Historical Ontology* (Cambridge, MA: Harvard University Press, 2004), 175.

² *Ibid.*, 176

³ Bernard Williams, *Truth and Truthfulness* (Princeton: Princeton University Press, 2002), 42.

⁴ *Ibid.*, 44

linguistic practices, may be compared from the standpoint of whether or not they enhance a person's dispositions to accuracy.

The main problem for my arch-rationalist argument is that styles of reasoning could not be evaluated according to how well they perform a function, if they do not have that function in the first place. Precisely this challenge is voiced by Hacking. In a review of *Truth and Truthfulness*, Hacking dismisses Williams's fictional genealogy of truthfulness as just another "just-so" story. He writes: "...I do not share with Williams the desire for a myth that makes telling the truth a necessary concomitant of the original possibility or usefulness of language...I do not even believe that these myths are useful."⁵ Hacking prefers the Foucaultian approach to genealogy—i.e., genealogy which recounts actual historical events.⁶ The rationale for this preference is evident in Hacking's own genealogies of styles of reasoning. Hacking's work shows that new styles of reasoning can arise due to factors quite unrelated to reasoning. They can, for instance, result from socio-political factors. Hence Hacking maintains that one of the causes for the emergence of geometric proof in ancient Athens as a distinct style of reasoning was the Athenians' argumentative way of life.⁷ Athenian citizens were accustomed to arguing endlessly about affairs of state. However, geometric proof was an exceptional mode of argument in that it provided a decisive way to stop debate. Consequently, geometric proof came to be exalted as a new way to tell the truth. Here we have an example of a style of reasoning which arose from contingent socio-political factors that have little to do with reasoning. In this case, the relevant factor is the Athenian penchant for arguing. Moreover, the emergence of geometric proof has little to do with the putative function of communicating useful information.

It will be argued that Hacking's genealogies do not discredit the idea that reasoning, as a linguistic practice, has the function of communicating useful information. Here I draw on Philip Pettit's notion of a *virtual function*.^{8, 9} The virtual function of a trait (or institution or practice) *T* is an effect of *T* which

⁵ Ian Hacking, "Truthfulness," *Common Knowledge* 11 (Winter 2005): 169.

⁶ *Ibid.*, 168.

⁷ Ian Hacking, *Scientific Reason*, 58 – 59.

⁸ Philip Pettit, "Functional Explanation and Virtual Selection," *British Journal for the Philosophy of Science* 47 (June 1996): 291 – 302.

⁹ Pettit himself does not use the term "virtual function."

explains why *T* is *resilient*. Pettit distinguishes resilience from the emergence of a trait and from its persistence over time. Resilience refers to the tendency of a thing to survive in spite of various counterfactual forces which could threaten its existence. Hence, the virtual function of a thing explains not just why the thing does not disappear, but why it *wouldn't* disappear under a range of possible contingencies which *could* be realized. According to Pettit, showing that a thing has a virtual function does not require an actual history of the mechanisms which explain why it came about and why it persists. It only requires an explanation as to why the thing *would* persist, *if* it were subjected to a range of contingencies. I shall contend that styles of reasoning have the virtual function of communicating useful information. As Hacking's genealogies suggest, the actual emergence and persistence of styles of reasoning may not be explained by their capacity to serve that function. Nevertheless, there remains a good case to be made that if a style of reasoning did not aid in the communication of information relevant to satisfying human desires and aims, it would be at a selective disadvantage to alternative styles of reasoning that could play this role more effectively. For it can be expected that people would (intentionally or not) coordinate on styles of reasoning which better served their interests.

The Geography of Styles of Reasoning: East & West; North & South

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Hacking's (1985) concept of 'styles of reasoning' has prompted research into a multitude of markedly different areas including: learning and teaching of science (Hawkins and Pea, 1987), the history and philosophy of the use of case studies (Forrester, 1996), epistemic differences in German and American embryology (Maienschein, (1991), the relationship between philosophy and history of science (Radder, 1997), and more recently even the

relationship between sexuality, translation and East Asian studies (Chiang, 2009).

This paper attempts to add to this discourse by considering the concept of 'styles of reasoning' from the perspective of history of science and geography in China. Firstly, it discusses observation and correlative thinking in the traditional Chinese science of *dili* (principles of the earth) and *fengshui* (wind and water), focussing on the meaning and difficulty of the translation of the concept *shi*, 'configurational force', which embodied an astute early qualitative understanding of gravity and its relationship to fertility. Seminal texts from various dynasties considered in this discussion include: the *Book of Burial*, *Classic of Burial*, *Yellow Emperor's Classic of House Siting*, *Arousing the Dragon Classic*, *Twenty Four Difficult Problems*, and *Water Dragon Classic*. The paper then argues that this the different 'style of reasoning' displayed in the discipline of *dili* became blurred into Western scientific styles of reasoning to become *dilixue* (geography). A journal article on the history of the development of the concept of 'mountain veins' in traditional Chinese science by a member of the Chinese Geological Survey, Weng Wenhao (1925), is indicative of this melding of Eastern and Western styles of reasoning. It is posited that even with the strength of China's early scientific foundations, the acceptance in China of Western styles of scientific reasoning was markedly accelerated due to the environmental history of China (Elvin, 2004).

The environmental history of China over 3000 years is then compared to that of Australia over the past 200 years using the traditional *dili* construct to argue that northern hemisphere peoples coming to the south have had to modify their styles of reasoning to perceive the ritualisations of knowledge inherent in northern knowledge systems, based on the generally more fertile geographies of the power bases of the north. It is argued that accepted 'universal' theoretical stances such as the market approach advocated by Hayek (1980 & 1976) has more of a geographic basis than is realised and that continuing to follow the 'logic of short term advantage' (Elvin, 2004) and the 'ethics of chance' (Paton, 2009) that have become major catalysts to present day

market based systems could have a very negative effect on the survival of the human species over the long term.

Jeremy Wanderer

‘The Happy Thought of a Single Man’: On the Legendary Beginnings of a Style of Thinking

In this paper, I want to direct attention to one pervasive feature of Hacking’s own discussions of styles of thinking (SOT), and to argue that this feature is of far greater philosophical significance than Hacking’s limited discussion of this suggests. The feature in question is his use of ‘legendary beginnings’ in setting out a given SOT, by which I mean the method of introducing an SOT by recounting a popular and quasi-mythical narrative that ties the historical emergence and establishment (the ‘crystallisation’) of that SOT to a particular person in a particular place and at a particular time. Whilst Hacking both deploys and discusses this method, his discussion suggests that this is primarily a stylistic device employed for literary or pedagogical reasons. In contrast, I want to argue that recounting the legendary origins of an SOT does philosophical work, in that it affords a distinctive way of vindicating that SOT, a vindication from within the style itself.

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What can styles of thinking do for the philosopher of science?

Hacking has claimed that with each style of thinking comes an ontological dispute, eg. with the mathematical style comes a controversy over the existence of abstract objects, with the taxonomic style a worry about species, etc. Recognition of this fact, it seems to be implied, is meant to help resolve or dissolve such disputes. In this paper, I examine these suggestions by

considering in some detail the laboratory style and the realism-anti-realism dispute over unobservables.

By considering the changes in the terms of the dispute over atoms pre and post the crystallisation of the laboratory style, I argue that a proper understanding of these events does indeed undermine philosophy of science 101 arguments for realism and anti-realism. However, I go on to argue that they have little bearing on more sophisticated arguments for anti-realism, inspired by developments in quantum theory, which motivate van Fraassen. I draw two conclusions from this discussion. Styles of reasoning don't dissolve realism-anti-realism disputes but they do help to clarify what, if anything, might be interesting or significant in such arguments. Second, van Fraassen's work highlights for us that styles and in particular standards of vindication evolve within a style. I claim this requires us to rethink Hacking's claim that styles are self-vindicating.

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The Laboratory Style of Reasoning, 'Historied Reference', and Theory Building

In reflecting on the history of reasoning and 'finding out' Ian Hacking proposes six styles of scientific reasoning, most of which – if not all - are used by any given science at some point in its development. In this paper I will focus on one of these styles, namely the laboratory style of reasoning according to which instruments and apparatus are created with the aim of "interfering with the course of nature in order to extract its deepest secrets" (Hacking 2009, 42-43). I choose to focus on this style of reasoning because it highlights the debate in philosophy of science around unobservables, which I have long suspected of being impotent. Specifically I shall argue here that, 1) in order to adequately assess the status of scientific knowledge, Hacking's laboratory style of reasoning (incorporating Crombie's experimental and hypothetical modeling styles) should be accompanied by a 'theory building' style of reasoning (which differs from the hypothetical style in interesting ways), and

2) both these styles of reasoning are underpinned by a theory of 'historied reference'.

The motivation for this claim briefly rests on two considerations: On the one hand, the kind of realism that goes with the laboratory style of reasoning, namely entity realism, is not adequate to do science justice. The reason for this inadequacy is mainly the fact that it ignores the interwovenness of theory and experiment and the need to analyze experiments "within the tradition in which it is embedded, as part of an ongoing process of inquiry about a given aspect of the world" (Vicedo 2000, 237) – see also Morrison (1990). On the other hand, theory realism is completely out of the question for reasons pointed out often and best summarised by Cartwright (1983), and also because 'truth' simply is not what scientific theories are 'about'. Rather theories are about interacting with reality, and truth is a functional notion in the sense that it is the flipside of reference. Now, the only way in which to make sense of 'reference' given the self-revising tentativeness of the set of processes we call science that still somehow manages to 'interact' with aspects of reality, is to use a causal theory of reference.

One important feature (and advantage) of causal theories of reference is their emphasis on empirical testing. Compare Psillos' (1999, 284) remark that "The determination of the reference (and the meaning) of a term becomes, by and large, an issue which cannot be solved *a priori* by means of conceptual analysis, but is amenable to empirical investigation into the features of the world and of the natural kinds that populate it". And, in this sense intervention and interference as understood in the laboratory style of reasoning become very important for working out a functioning theory of reference.

In this paper I thus show links between the laboratory style of reasoning and a form of causal reference that imply that neither entity nor theory realism is adequate to portray the movements of our knowledge of reality. Instead, what is suggested by the theory of reference I propose, is that realism about *scientific interaction* may be possible. There are many levels of interaction at issue here: 1) interaction between theory and experiment (e.g. Hacking (1983, 155-162), Suppes (1967), Galison 1987); 2) different kinds of interaction with aspects of reality including actions of observing, experimenting, representing, referring, intervening, manipulating, dialogue, explaining, describing, etc.; 3)

cross-informative 'background' theories' interaction with both empirical and theoretical work; 4) interaction among various stages of development of the same theory reflecting the heuristic value of 'misguided theories' or 'mismatched representation'; 5) interaction among various versions of the same theory, or among theories investigating the same aspect of reality, reflecting different degrees of continuity manifested by theory change and the heuristic coherence of the layers of information expressed by incompatible theories.

I show that discussion of these various levels of interaction implies that the laboratory style of reasoning is best accompanied by a 'theory building' style of reasoning. I argue that the 'practice of truth-fullness' of the latter style of reasoning centers around establishing reference by means of the causal theory of reference I develop in this paper, and which I call 'historied reference' - 'historied' in the sense of meaning 'adorned with historical incidents'. By unpacking my theory of 'historied reference' and arguing for the interlacing of laboratory and theory building styles of reasoning, in conclusion, I show that indeed, as Rorty (1979), Fine (1986), and Hacking have argued (albeit not for the same reasons necessarily) the current realist debate is empty - and incapable of reflecting the actual workings of science.

Bibliography

Cartwright, N. (1983). *How the Laws of Physics Lie*. Oxford, Oxford University Press.

Fine, A. (1986). 'The Natural Ontological Attitude'. In, Fine, A. *The Shaky Game: Einstein, Realism, and the Quantum Theory*. Chicago, University of Chicago Press.

Galison, P. (1987). *How Experiments End*. Chicago, University of Chicago Press.

Hacking, I. (1983). *Representing and Intervening. Introductory Topics in the Philosophy of Natural Science*. Cambridge, Cambridge University Press.

Hacking, I. (2009). *Scientific Reason*. Taiwan, National Taiwan University Press.

Morrison, M. (1990). 'Theory, Intervention, and Realism'. *Synthese*, 82: 1-22.

Psillos, S. (1999). *Scientific Realism. How Science tracks Truth*. Boston, Routledge.

Rorty, R. (1979). *Philosophy and the Mirror of Nature*. Princeton, Princeton University Press.

Suppes, P. (1967). 'What is a Scientific Theory?' In, Morgenbesser, S. (Ed.) *Philosophy of Science Today*, New York, Basic Books.