Internalism, Externalism, Contextualism, Dynamicism

A look at the historiography of science.

Internalism and Externalism shared a conception of science, what Schuster[1] called a 'deep grammar'[2], of Science as having an Inside and an Outside. This is what Contextualists feel has been transcended, which is true to some extent. However, I will argue that all three historiographies fail to properly consider science as a dynamic discipline, a process that can change over time. This change is based not only on social factors inside or outside the discipline, but also on intellectually constructed objects of inquiry that are investigated by the discipline. To this end, I will briefly outline my own theory, Dynamicism, which places a priority on the processes involved in the continuation of science as a discipline, in particular the acquisition and maintenance of intellectually constructed objects of inquiry.

Before doing this I will look briefly at Internalism, Externalism, and Contextualism, giving a brief summary and enumerating some of the features of each, in particular those that were the most and the least admirable.

Internalism and Externalism

When considering internalism and externalism, it is to some extent necessary to look at them in contrast, as they each define themselves in the denial of their opposite. Because of this, I will review the two in an interwoven fasion. Let us begin with Internalism.

[1] Schuster, J. *The Scientific Revolution: An Introduction to the History and Philosophy of Science*, Schuster, Wollongong, 1995

[2] ibid., p 206 (figure 1a)

Schuster[3] summarised the classical view of Internalism:

> Internalists believed that scientific ideas and methods are autonomous, unfolding through the internal dynamics of rational thought and procedure alone, with social and economic circumstances at best affecting the timing or direction of research and at worst hindering progress.[4]

That is, internalists felt that Science could be explained purely by explaining how the metaphysics and ideas held by a person allowed him (and it usually was 'him') to create the theories he did. Because of this emphasis, internalist history tended towards being the 'history of ideas'. Koyré in particular reads like a genealogy in some parts. It is as though he was saying "Copernicus begat Galileo, Galileo begat Newton, and Newton begat Modern Science". In fairness, this was Koyré's project, to trace the development of ideas over time in Science, and he was very good at it. What Koyré did introduce that was important were the kernels of the modern ideas of revolution, and more importantly for this essay, of the theory-dependence of observation, in his ideas about the correct metaphysical background being required to be able to conceive of a theory.[5]

The externalists, on the other hand, emphasised the importance of social and economic forces and downplayed or ignored any 'internal' factors. Schuster:

> Externalists, especially of the Marxist school, held that content as well as the direction of scientific knowledge was shaped by technological pulls that ultimately depended upon economic and social forces and structures.[6]

The reason for this emphasis is that, in the Marxist view, the methods and means of production are the fundamental factors underlying the form of a

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[3] Schuster, J. 'Internalist and Externalist Historiographies of the Scientific Revolution' in AppleBaun, W. (ed.) *The Encyclopedia of the Scientific Revolution*, pp 334-6.

[4] ibid. p 334

[5] Schuster (ibid. p 205) speaks of this, but if one looks at any of the papers reprinted in Koyré, A. *Metaphysics and Measurement*, Chapman & Hall, London, 1968, it can be clearly seen, this project of explaining the discoveries by explaining the metaphysical background.

[6] op. cit. 3 p 334

society. Hessen[7] puts it more succinctly:

> The method of production of material existence conditions the social, political and intellectual process of the life of society.[8]

The extreme externalist position thus holds that the ideas and directions of science are completely shaped by social forces, that is, that the 'inside' of the scientific field is a *tabula rasa* to be imprinted on by society at large.

Because of this, Externalist histories of science looked at the larger social unit surrounding the 'inside' of the science. Hessen, for example, was concerned with the connections between Newton's *Principia* and the simultaneous development of the bourgeoisie and capital, and the creation of technical problems that were then solved by the application of Newton's work. From this he draws the conclusion that the bourgeoisie were responsible in large part for the creation of Newton's work, and the input from the man himself was simply in the form of being in the right place at the right time. I can certainly see how Koyré and the Internalists would have felt about statements like this.

Perhaps a less polemic example is Bernal's *Science in History*.[9] This is Bernal's attempt to tell the entire history of science in an Externalist (or more correctly, Marxist) fashion. Bernal looks at art, medicine, government, trade, capital, engineering, and many more factors, but of course does not consider the 'inside' of science to be worth studying in and of itself. He does mention the development of ideas such as perspective, but only in the context of developments in art, which then spurred on the development of science.

It can be seen that both Internalist and Externalist positions agree on two main points: Science has an 'inside' and an 'outside', and these two areas have minimal or neglectable effect on each other. The 'inside' of science consists of all of the ideas, theories and Method, while the 'outside' of science

[7] Hessen, B, *The Social and Economic Roots of Newton's 'Principia',* Current Book Distributors, Sydney, 1946.

[8] ibid. p 9

[9] Bernal, J.D. *Science in History*, Vol 2: 'The Scientific and Industrial Revolutions', Penguin, Middlesex, 1969.

consists of the larger society. This agreement is what Schuster means by ‘deep grammar’.

What the two positions are arguing about is which area determines the course of science. The primary factor affecting who became proponents of one side or another in the argument was the relative desirability of incorporating Marxist thinking into the story of the workings of Science. In other words, for scientists in the West during the Cold War, anything that smacked of Marxism or Communism was to be avoided, while for scientists behind the Iron Curtain, the converse was the case.

However, it should be reasonably obvious to the modern reader that there is a very large flaw in the deep grammar of the debate, a flaw that began to be exposed in the 1970s. That is, that there is no such thing as Science (capital S), or Scientific Method. Instead, there are sciences that each have their own methods. This was the challenge that produced the point of view said to have ‘transcended’ the internalism/externalism debate, contextualism.

Contextualism

The primary idea of contextualism is that the ‘insides’ of the sciences are completely different in structure to what the previous debate allowed for. That is, as Schuster puts it:

> Inside a science we do not find concepts or ideas or theories rattling around in a void. We find a social institution: People in social and institutional relations – the people being professional practitioners of that science.[10]

This implies that both Internalists and Externalists were incorrect. The Internalists in that science is not created wholly out of a continuum of ideas, and the Externalists in science not being moulded wholly by forces in the larger society. Instead, science is affected, and in turn affects the larger society in which it is a part.

[10] op. cit. 1, p 215

However, it should be noted that one of the properties of this contextualist mode of study is that it leaves the study of the objects of science, the qualities that were emphasised by the Internalists, out of the picture. Instead the focus is on micro-social study of the institutions and cultural forces acting on certain people at certain times. Schuster states the problem of purely contextual history of science:

> Local studies of specific times and places, indebted to the sociology of scientific knowledge, are difficult to link to the long-term dynamics of knowledge-making subcultures or to wider contexts and their dynamics.[11]

In changing the level of study to the closer context of science as it developed, the Contextualists are falling into a similar trap to the Externalists': that of ignoring the knowledge and ideas of science. In other words, the problem with Contextualism is the same problem as with Externalism; it is just that the level of study has changed to be closer to the figures being studied. This removes the 'problem' of history of ideas by considering the ideas and methods of science to be artifacts of the social process, to be only worth studying *as social epiphenomena*.

To state this again: the change of focus from macro to micro studying tends to hide a de-emphasis on studying ideas that is very similar to that of the Externalists. Instead, sociologists of scientific knowledge can hide behind talk of scientific facts as sociological artifacts that are only worthy of study as elements in scientific discourse and debates, rather than objects that, while psychological in nature, can still affect the course of the sciences in interesting ways. This is a crucial problem. It seems plain to me that, when a person claims allegiance to a certain school of thought, there can be more at play than that person making a decision based only on the political and economic factors influencing that school. Practitioners of a scientific discipline make judgements about arguments within their disciplines. The judgement

[11] op. cit. 3, p 336

they make is affected by socioeconomic factors such as political power, scarcity of resources, and so on, but is, in the end, a cognitive event, and one that can serve as a factor affecting other, social decisions.

To be fair, however, there are many good reasons for leaving aside the study of the objects of inquiry of science. The problem is that to think of ideas as possible factors modifying the course of scientific endeavouris to start down the path towards platonistic ideas, to the idea that this knowledge has some kind of existence apart from the communities that use it, and from there to move towards the history of ideas. This kind of doctrine has many problems in dealing with the actualities of the history of science, in that it is quite plain that highly intelligent people have believed things that were later discarded.

It should be obvious that if knowledge has an existence apart from the people using it, then it is implied that there can only exist 'true' knowledge, in the philosophical, eternal sense of the word, and thus that, if we are not to believe that what we now know is incorrect, then all of the (very intelligent) people who practised the sciences before now were wrong. In other words, if one thinks of knowledge as having a separate existence from the people who use it, one almost inevitably ends up espousing a kind of Platonism, placing primacy on some Form that exists independently of the physical world. Given the well-documented changes in the history of science, this is obviously not the case. That is, given the historical fact[12] of scientific revolutions, it is impossible to argue for an idealistic Platonism without ending up with a Whiggish history of ideas, when the facts about revolutions suggest that there is a good change that today's theories will be proved to be wrong in some fashion in the future.

We are therefore left with a quandary: given the possibility that we might be wrong, and also given effects such as the theory-dependence of observation, how is it possible to think of scientific ideas as anything other that sociological

[12] in the strong use of the word.

epiphenomena? This is the question I will attempt to answer with my ideas of Dynamicism.

Dynamicism

Question the first

As I said before, Dynamicism seeks to emphasise the study of scientific disciplines over time. The first question to be answered is: What makes a scientific discipline a tradition? What creates the persistence across time of the sciences as entities?

Dynamicism borrows the answer to this from the Internalists: it is the ideas, knowledge and methods that create science as a persistent tradition. However, appealing as this may be to anyone with internalist tendencies, the problem that arises from this relates to the objections raised previously about the persistence of ideas in the absence of a neo-Platonic, Form-filled universe. Obviously, anyone with any pretensions at all to being a good historian of science does not want to be writing Whiggish histories of ideas, for reasons outlined above.

Dynamicism does this in part by borrowing from the works of Jerry Ravetz[13], in particular his ideas of intellectually constructed objects of inquiry (ICOI)[14] to create a means by which ideas may be given a more pivotal role than has been ascribed to them in the past.

Ravetz's ICOI

The ICOI are a large part of Ravetz's ideas about what makes science special. Ravetz's argument is that science is the only field of human endeavour that operates wholly on objects that are not real in the same way

[13] In particular Ravetz, J.R. *Scientific Knowledge and its Social Problems*, Second Edition, Transaction, New Brunswick, 1996 (originally published 1970)

[14] Ravetz actually refers to them as 'intellectually constructed classes of things and events' (see ibid. pp 110-4 especially), but since these are also the objects of inquiry of science, it makes sense to use the condensed term.

as they are in handicrafts. They are negotiated and constructed via social processes in the scientific community. In other words, they are 'intellectually constructed'.

According to Ravetz[15], the scientist's tools (by which is meant the objects of inquiry being used in a particular research project) are varied, and are special because they are the result of the research process, that is, they are intellectually constructed objects of inquiry themselves. In other words, the scientist's tools are objects of inquiry that have been constructed and negotiated by social processes in the scientific community before being accepted as standard and encapsulated. The outcome of successful research is that any modifications to the standard objects or additional objects become accepted as standards themselves after being discussed by the community.

The important point here is that intellectually constructed objects of inquiry are not only the objects being researched, but also the outcome of research.

Ravetz puts it as follows: 'the individual phase of the investigation of a problem [is] followed by the social phase of the testing, through use, of its solution.'[16] After the social testing phase, the work can become encapsulated, and be taken as given, to be taught to students as "the facts", and be used by experts in other fields without knowledge of the negotiation process by which the tool was created. However, says Ravetz, 'a solved scientific problem is not, and cannot be, a closed and perfect structure.'[17] It is possible to re-open discussion and debate about any scientific object, questioning the assumptions that were made in generating it, or questioning the data used, the tools used, and so on.

The most important part of this part of Ravetz's work for this project is the

[15] In particular, see ibid. ch 6 ' Facts and their Evolution' (pp 181-208), and also pp 110-4 (on the intellectually constructed objects of inquiry).

[16] ibid. p 191

interaction of cognitive and social factors in the creation and maintenance of scientific objects of inquiry. This follows to some extent from the historiographical ideas of those who study the Sociology of Scientific Knowledge, but I propose to take it much further.

Question the second

The second question to be answered is: Why? Why do I find the alternatives to Dynamicism so unsatisfactory? And what is so good about Dynamicism?

I would hope that some of my reasons are plain from the sections about the alternatives. Internalism and Externalism were both limited by their ideas of what science actually is, while Contextualism is limited by the categorisation of cognitive aspects of science as epiphenomena not worth considering.

The theme that underpins all of the above objectsions is that all networks, including social networks, are made up of both individual units and the connections between them. With respect to science, this means that it is important to remember that science is a discipline participated in by real people who have different opinions for different reasons, not all of them determined purely by social interactions. In other words, cognitive events can and should be considered as proximate factors in the outcome of events, regardless of your beliefs about the status of cognition (that is, whether it is a genuine phenomenon or artifact of external processes.)

In particular, the above historiographies fail to take into account the perception by practising scientists of being part of a *tradition*, of following the work of others. This is the feeling that leads to the Internalist type of historiography. Why does this feeling exist?

The answer: because the objects of inquiry of science are taught to new students in a way that allows them (under certain circumstances) to be

[17] ibid. p 193

reopened, questioned, and renegotiated, these ‘same’ objects, in a difficult to define way, can be considered to be the descendents of those objects used by any other person practicing what we now think of as science. In other words, the possibility of change in the objects of inquiry predisposes one to think in terms of a flow of ideas over time in the discipline. To put it even more concisely: *the changing nature of the objects of inquiry creates a feeling of continuity with previous experts.* The fact that scientist Y can say “This work of mine is based on the work of scientist X” implies a genealogical relationship of ideas between X and Y. An explanation needs to be provided for this relationship.

This idea of the changing nature of objects of inquiry creating continuity may seem like a paradox, but perhaps some examples will serve to make it clearer. A predicate is that, in order to remain viable fields of study, there must be unanswered questions in a discipline. If all of the questions are answered, and thus the objects of inquiry are fixed, then the discipline is obviously no longer a field in which it is possible to do any worthwhile research. The canonical example of this is Euclidean geometry. In this case we have a whole field being basically completely explained. That is, in geometry before Riemann and the rest, there were considered to be no problems worth considering, and the entire field became encapsulated, taught to students, and then used solely as a tool. However, when the tool was reopened to study by the questioning of some of its axioms, it became a viable subject for research again, and then was again encapsulated and used as part of the toolset for dealing with general relativity.

Because of this effect, a scientific discipline must keep moving, revising its objects and adding new ones, if it is to survive as an active discipline. However, it is this dynamic nature that allows practitioners to trace the antecedents of any object of inquiry, as it is clear that the objects of inquiry have changed over time, and thus one can trace the similarities and differences to the currently accepted object of inquiry backwards, creating a ‘history of ideas’.

In this fashion, the construction of scientific objects of inquiry via a social process can lead someone not well-versed in the low-level actualities of the social processes of science towards the history of ideas. However, this same point also allows for the consideration of cognitive factors over time in any historiography of science that recognises the importance of social factors as well.

An important and very interesting corollary to these points about the historiography of science is that, when studying science at this kind of meta-level, the objects of inquiry being used are subject to the same rules as the objects of inquiry being used in the practice of science, and indeed are a part of most scientists tool set, most likely on an implicit level. The end result of this is that discussions about the historiography of science can be taken by practicing scientists to be a normative description of what the field should be like. This is in part why the perception of the unity of Science existed and still exists. Accounts of science such as Koyré's or Popper's appeal to the scientist's conception of science that has been drummed into him since school.

Thus, one of the biggest problems with the sociology of scientific knowledge and contextualism is that, for scientists who have been trained without explicit history and philosophy of science training, it is difficult to see the social challenges to internalist-type historiographies as a good thing. This is because to some extent they undermine the faith practicing scientists have in their tools. This is an undesirable outcome for most, and until a mechanism is provided for scientists to understand how there can be social factors influencing the sciences at the same time as the ideas the are familiar with are being studied, there will always be a disconnection between those who study the workings of science and those who practice it.

Dynamicism is part of an attempt to create a historiography that can be encapsulated and shown to scientists in order to explicate to them how what they do can be simultaneously about the studying of objects of inquiry, that have a kind of existence apart from the social processes that create and

maintain them, and also about the social processes that create, negotiate, and maintain those objects of inquiry. In essence, it is about creating an account of science that takes into account social forces at the same time as showing the scientist how these social forces can produce the picture of science that they recognise. Of course, I do not claim that this is a complete theory (it would require a book to explore fully), but it is a beginning.

Question the third

The third question that needs to be answered is this: What is Dynamicism?

Dynamicism is the belief that science is a part of the social tapestry of the modern world, and is affected by it even as it affects the world. The reasons for this interaction are a large number of factors that are not limited by the division into science of ‘social’ and ‘cognitive’ areas. ‘Cognitive’ factors can influence the flow of science as much as ‘social’ factors can. Instead, historians of science should look at the proximal factors for any particular event, with an appreciation for how science has evolved, and continues to evolve, as an expert discipline with its own unique objects of inquiry that are both the results and the tools of the research process, which is itself an extension of the training given to the practitioner during their training in the discipline.

Conclusion

It is widely accepted that Internalism and Externalism were misguided in their attempts to explain the history of science with the underlying view of Science and Scientific Method. However, I contend that Contextualism was also misguided, although to a lesser extent, in not considering the objects of scientific inquiry as worthy of study. I have put forward my own historiography, Dynamicism, which places no restrictions on what can be looked at when studying the history of science. Instead, using Ravetzian ideas of intellectually constructed objects of inquiry, it allows for the explanation of science as a dynamic tradition of practice, where the ‘cognitive’ elements can have as much effect on the direction and methods of science as ‘social’ ones.

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