

Interdisciplinary Research: Some Practical, Methodological and Philosophical Reflections

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Introduction

Daniel Sandars (<http://www.relu.ac.uk/research/Discussions%20on%20interdisciplinarity.html>) provides an extremely interesting analysis of the ways in which interdisciplinarity played an essential role at the foundation of Operational Research (OR). As Sandars puts it, the interdisciplinary character of OR has not thrived since, due partly to pressures within a predominantly monodisciplinary academia. However, the need for interdisciplinarity never went away and is now growing in prominence due to the increases political importance of complex problems such as sustainable development. I would like to develop some of the points Sanders raises but in the context of political science with a particular focus on its potential for collaboration with the biological sciences.

I have now worked on two Rural Economy and Land Use (RELU) projects based at the University of Warwick (one on the environmental and regulatory sustainability of biopesticides, the other on the Governance of Livestock Diseases). This has given me an invaluable insight into interdisciplinary research. Some of the arguments here are inspired by an unpublished paper by my Warwick colleagues Dave Chandler, Wyn Grant and Mark Tatchell, along with presentations they have given on the topic. I have also, however, developed many of my own thoughts, not least on some of the methodological, philosophical and practical implications of working across the natural and social sciences. I will also develop these in this paper.

Political Science and the Scope for Interdisciplinarity

Political Science is often portrayed as the 'junction subject' of the social sciences, born out of history and philosophy but drawing on the insights of cognate disciplines such as economics and sociology, and to a lesser extent the study of law, psychology and geography. I discuss this each year with my 1st year Research Methods students at Warwick and it is clear to them how much politics overlaps with many of the other subjects they have studied at A level. This openness has been a strength fostering interdisciplinary work within the social sciences. Writers such as Moran (2006) and McKenzie (2007), however, have taken a rather pessimistic view about the possibility of such interdisciplinary collaboration. They seem to assume that 'interdisciplinarity' refers to collaboration within the social sciences. I intend here to broaden out the discussion to collaboration between the social and natural sciences. I would argue that many of today's most pressing problems – such as climate change, GM technology and stem cell therapy – can only be addressed in a meaningful way through a combination of social and natural science.

In some respects collaboration with the natural sciences may be easier for political scientists than with other social sciences. As Chandler et al (2007, p. 6) have put it 'The sheer distance between the two sets of disciplines may of itself create an initial atmosphere of mutual respect and willingness to learn from each other'. The biological sciences have long enjoyed various affinities with political science. The first substantive chapter of W J M Mackenzie's survey of political science is 'The Biological Context' (1967). Punctuated equilibrium models have their origins in evolutionary biology.

Mackenzie focuses particularly on social biology, encompassing not only humans and other primates but other animal groups such as social insects. The interaction between entity and setting is amenable to political scientists who look at how institutions can shape the conduct of political actors. Biologists are often interested in adaptation to environment and there is a sense in which that is also true with politics, eg: regional forms of government as a response to a more independent world.

Practical Challenges

Working on these two RELU projects has opened my eyes to the challenges of interdisciplinary research. The biologists thought that political scientists might be identified with a particular political position. However, they came to appreciate that they were policy analysts who used theories and categorisations to derive and test hypothesis in a similar way to biology. A procedure has been followed in our team meetings of each discipline reading literature selected from the other discipline and then presenting their understanding of the piece to the meeting. This helped clear up any misunderstandings and created an understanding of how the other discipline worked in terms of methodologies and the vocabularies it used to present its findings. It became obvious that political science articles were much more discursive than those written in biology. A particular challenge has been writing journal articles together. Biological scientists are used to writing tersely argued research papers that present key findings in a few printed pages, perhaps as few as one. Differences in writing style can make it a challenge for the work to 'flow' appropriately. The risk is that any writing becomes disjointed and does not read well.

Furthermore, there are challenges for early career researchers. Research Councils and funding bodies are very supportive of interdisciplinary research; in a sense, it is 'the only game in town'. However, it is not clear whether the Research Assessment Exercise (RAE) has caught up with this. Interdisciplinary articles in interdisciplinary journals may not carry so much weight. As Grant puts it (2006, p. 135), 'Submitting to a journal outside your own discipline carries with it particular hazards, not just in terms of readily understanding the particular expectations and requirements but also how well the article will be regarded in RAE terms'. Papers based on RELU projects can be published in disciplinary journals; however, its interdisciplinary dimension may have to be toned down if it is to be accepted. This difference between funding body and RAE expectations needs to be tackled. Similarly, when making appointments departmental interview panels will need to show flexibility and an appreciation of how interdisciplinary research is changing the ways in which the academic world (and the journal market) is working. Linked to this, biological scientists are used to articles written by an entire research team or project (a very interesting example can be found at <http://www.nature.com/nature/journal/v409/n6822/pdf/409860a0.pdf>). Whilst things are starting to change in the political sciences, it remains the case that only pieces written by one or two authors carry much weight in an RAE context. As Chandler et al write (2007, p. 5): 'The remedy here is for those running interdisciplinary projects to ensure that career entrants at postdoctoral research level are given the encouragement and support to publish their own work from an interdisciplinary project'.

Doctoral Training Centres (DTC's)

Another interesting idea is that of Doctoral Training Centres (DTC's). These are a recent phenomenon in UK postgraduate education which aim to produce interdisciplinary PhD students.

This is something hard to achieve within more traditional university departments. Research in the life sciences has dramatically changed since the sequencing of human and other plant and animal genomes. This results in a need for scientists who are competent in the mathematical and statistical tools needed to analyse genomic and systems data as well as a good practical understanding of 'wet' science. It is for this purpose that DTC's were created; an example is the Complexity Science Doctoral Training at Warwick. As their website puts it:

Complexity Science focuses on systems of many independent components, showing Emergent behaviour at the systems level, Self-Organisation and/or Evolution. Our Centre draws on aspects of these in existing fields, including mathematics from dynamical systems and chaos, statistical inference, physics of phase transitions, self-assembly in chemistry, network modelling in biology and neuroscience, interacting modelling in economics and computer science. We also look to apply scientific methods in new fields of opportunity, such as transport, health and social science applications where mass quantitative data is newly available in this information age.

(http://www2.warwick.ac.uk/fac/cross_fac/comcom/dtcsite/, accessed 15 July 2008).

Whilst DTC's in their current format are very much natural science focused the above quote demonstrates a branching out to economics and the social sciences. I believe the DTC model (or equivalent) could offer a great deal both to political science as a discipline and politics graduates in terms of transferable skills. Employers who are receiving the first graduates from DTC's feel confident that over a conventional PhD candidates have highly developed communication skills and have worked on a range of projects in addition to the conventional thesis. DTC's (or their equivalent) involving the social sciences could help promote interdisciplinarity and offer the transferable skills required for the modern knowledge based economy. In short, they could be linked to the innovative political science departments of the future.

What is Interdisciplinarity?

It is important to understand what we mean by 'interdisciplinarity' As Harvey puts it (2006, p. 331). 'There are nearly as many definitions of the term as there are researchers trying to do it'. Sandars makes an important point when he says 'Multi-disciplinary collaboration does not imply interdisciplinarity. How often does one come across models where the mathematician did not appreciate the implication of the biologist's assumptions and the biologist did not realise their sensitivity in the model'. Certainly there is an important distinction to be made. As Philip Lowe and Jeremy Phillipson (2006 p. 167) put it:

Interdisciplinarity differs from disciplinarity and multidisciplinary in the emphasis it places on interaction and joint working, which brings the knowledge claims and conventions of different disciplines into a dialogue with each other, yielding new framings of research problems.

In our biopesticides project the challenge was to ensure that each discipline was affected in a positive way by the other discipline. For the political scientists, the technical understanding of the biological scientists was essential to the interpretation and understanding of the regulatory frameworks studied. The natural scientists also discovered that they had a lot of information and understanding about decision-making processes and policy networks but had never been utilised

systematically. The biologists, by their own admission, were encouraged to pursue a more deductive theoretically driven approach by the political scientists. One difficulty, however, was one of methodology. Semi-structured interviewing (used by political scientists) is a flexible method. As the research proceeds one can redefine the focus both in terms of who is interviewed and what they are asked about. In contrast, research in the natural sciences has to follow established protocols to be taken seriously and this reduces the speed at which the research programme can change direction. In the plant sciences, the rhythms of planting, growing and harvesting, and the need to replicate experiments, impose additional restraints. Therefore, the greater challenge can be to achieve a flow in direction from the political to the biological scientists.

McNeill (1999, p. 313) goes even further when he argues that interdisciplinarity involves 'the formulation of as uniform, discipline like terminology or common methodology' as well as 'co-operation within a common framework shared by the disciplines involved'. 'In short', argues Harvey (2006, p. 331), 'interdisciplinarity requires a common language'. This, in my view, is where things start to get interesting. Even taken as an individual discipline, politics as a junction subject is open to the accusation that it lacks a distinctive theoretical and methodological core. 'We cannot talk about political science as a discipline if those who call themselves political scientists and pretend to teach it are unable to agree on its basic substance and methodology' (European Thematic Network for Political Science, 2003, p. 2). Some, therefore, argue that politics is a field of enquiry rather than a distinctive discipline. The lack of a methodological core may, of course, provide the flexibility required for interdisciplinarity. On the other hand, if political scientists cannot agree on a common methodology, is it realistic for those of different disciplines being able to do so?

Some Philosophical and Methodological Issues

Some within political science (studies?) take an essentially interpretative or 'hermeneutic' methodological approach. In essence, they argue that the objects of study of the natural and social worlds are so different that they require different methods of investigation (Benton, 1977). This philosophical tradition can be traced through Weber and Dilthey to the transcendental idealism of Kant. The most usually cited, however, is the philosopher Peter Winch (1958). He rejects Popper's claim that it is possible to develop a causal analysis of action in the social sciences. The relationship between an act of command and an act of obedience is not the same as the relation between thunder and electrical storms, since human actions belong to the realms of concepts and 'the relation of belief to action is not external and contingent, but internal and conceptual' (Winch, 1958). Interpretivists are sceptical of the notion of objective reality and there are links here with post-modernism. I recently attended a recent workshop to promote interdisciplinary research between natural and social scientists where a sociologist stated the post-modernist mantra of 'there is no truth'. Apart from the obvious logical contradiction in such a statement (ask yourself: is that statement itself true or false?), it struck me that such a philosophical viewpoint would be unlikely to attract natural scientists to the interdisciplinary cause. Indeed, one wonders what the purposes of academic research would be at all if there is no objective knowledge and all 'relative' or 'subjective' viewpoints are equally valid.

There is, however, a feeling amongst some natural scientists that their discipline can provide proof or a higher degree of certainty than the social sciences. Furthermore (and this is a related but subtly different point), they may feel that social scientists hold beliefs/make statements which are not

backed by sufficient evidence to justify the confidence to which that belief is held/statement is asserted. Such viewpoints may hinder respect for the social sciences and make successful interdisciplinary research more difficult. This, of course, all touches on philosophical notions of probability, certainty, and justified true belief which are worth a book in themselves. Certainly I have some sympathy with the natural scientists position. Popper argued that theories should be only considered scientific if and only if they are falsifiable. This led him to attack both psychoanalysis (the body of knowledge developed by Sigmund Freud and his followers) and Marxism on the grounds that such theories could not be falsified as they were not sufficiently precise. This problem applies to many theories used in the social sciences and overlaps with what Merton (1967) referred to as 'Grand Theory'. Sociology, for example, focuses on many theories with a high level of abstraction. Examples include structural-functionalism, symbolic interactionism, critical theory, poststructuralism, structuration theory and so on. If someone wanted to test such a theory or draw an inference from it that could be tested, the level of abstractness would probably be too great to allow the researcher to make the necessary links with 'the real world'. These contrast with 'theories of the middle range' (Merton, 1967) which are an explanation of observed regularities and operate in a more limited domain.

Nevertheless, elementary philosophy of science teaches us that the natural sciences may not be able to provide levels of proof often assumed. Most observations in the natural sciences are also 'theory laden' or 'theory dependent'. There is also Popper's problem of induction: how can one rationally prove that past events will continue to repeat to the future just because they have repeated in the past. Many philosophers have attempted to resolve the problem of induction but with little success. As Bertrand Russell (1912, p. 6) put it:

The general principles of science..... are believed because mankind have found innumerable instances of their truth and no instances of their falsehood. But this affords no evidence for their truth in the future, unless the inductive principle is assumed'

Another problem is that of 'causation' (briefly referred to by Sandars). In political science it is difficult to prove causation through either case studies or the comparative method. In the case of the latter, the political world is too rich and varied (eg: it consists of too many variables) for the researcher to be able to find enough cases to control for all the effects of these variables. The comparative method, therefore, can rarely, if ever, resolve the fundamental problem of causal inference. Statistical methods allow us to study correlation but provide only clues about and do not prove causation (Healey, 1999). Experiments, of course, are widely considered the best way of determining cause and effect in scientific research. In the laboratory the scientist is able to control all the variables and, furthermore, manipulate the independent variable (the 'cause') in order to measure its effects on the dependent variable. However, such experiments are often not possible in the social sciences. Furthermore, it is doubtful whether they solve the problem of causation. As Burnham et al put it (2008, p. 171), 'it is seldom or even never possible to observe causality, which would require us to be able to observe a case where one factor generates a particular effect, as well as being able to observe the same case without the factor previously seen to generate the effect'. Natural scientists try to get round this by designing experiments where the cause (stimulus) is included in one run and excluded in others. This has many methodological problems, not least in that it makes an assumption about temporal reality, that is, that the cause has the same effect over time.

Grant refers to a further methodological problem: namely, the individualistic or reductionist fallacy. As Macintyre (2005, p. 43) argues, it is a 'logical error to draw conclusions about groups based on data gathered with the individual as a unit of analysis'. The fallacy, therefore, involves generalising from individual behaviour to aggregative relationships. In biology an individualistic fallacy can be committed in two ways: (a) by making an inference about a group from data collected on an individual of the same species; (b) making an inference about one species from data collected on another species. There are ways for biologists to get round this but there is a real scaling up problem in biological sciences. Can the experiment done on an individual level in plant pots be scaled up to field level, to farm level and then on a broader scale? There is a propensity to overlook the broader consequences of solutions that work well at a micro level. Of course, social and political scientists are equally prone to commit the individualistic fallacy; particular care has to be taken, for example, when handling case studies.

Conclusions: the Google Generation, Facebook and Interdisciplinarity

There are practical and philosophical challenges to successful interdisciplinary research. These, however, can often be overcome and may not be as great as first assumed. Many of today's political and social problems require interdisciplinary research to come to solutions. As Sandars puts it (citing Ackoff), 'closing the gap between the natural and social science worldviews is as challenging as it is important'. Social scientists can learn much from the academic rigour of natural scientists, whilst natural scientists should accept some of the methodological and philosophical limitations of their disciplines. To return to the students I teach, some have taken predominantly science A-levels and made the transition to study Politics at university; others ask stimulating questions in seminars on the methodological differences between the natural and social sciences and the issues I have raised in this paper; many are keener than ever to take outside modules. In today's liberalised world, with old barriers coming down, students will be less keen to be restricted to the rigid confines of one academic discipline (one reason why I am so keen on DTC's). Employers will also be looking for the skills which interdisciplinary research will bring. The Google generation have easier access than ever to a wealth of information across all disciplines on the internet (although information is not quite the same as knowledge – the latter requires understanding and theoretical/analytical frameworks). Interdisciplinary discussion groups are appearing on social networking sites such as Facebook. This is all creating an encouraging and stimulating environment for the interdisciplinary research of the future to thrive.

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