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The Humanities and Social Sciences in a Technological Age

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THE HUMANITIES AND SOCIAL SCIENCES IN A TECHNOLOGICAL AGE[1]

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Abstract

The first task is to assert the core values of the humanities and the social sciences and then to explore the challenges and opportunities for these disciplines in a technological age. It is argued that progress will be enhanced through interdisciplinarity. What does the technological age offer these disciplines? Certainly, a new kind of society to understand; but, directly, computing power and the internet. These offer unprecedented access to data – both contemporary and archival – and so new research opportunities together with the challenge of inventing search engines that maximise these opportunities.

The combination of interdisciplinarity and computing power generates new research that crosses humanities and social science boundaries. This will be illustrated by three examples: modelling the evolution of contemporary retail structures, combining ideas from geography, economics, physics and ecology; modelling settlement structures in ancient Greece, thus bringing contemporary social science into archaeology; and modelling the evolution of the United States urban system from 1790 to 1870, illustrating the impact of the railways.

The lecture concludes by briefly reviewing the potential impact of new research on public policy and makes recommendations to both government and academia.

CORE VALUES

In a time when Government priorities can be seen to be focused on STEM and 'impact', it is important to assert that the humanities and the social sciences not only remain important in a technological age but are increasingly so. The old arguments still stand; but there are also huge new opportunities. I am going to take the old arguments for granted but will summarise them briefly. Sir Patrick Stewart captured the core for the humanities as follows:

[1] A lecture given at the University of Strathclyde, 5 October 2010. I am grateful to Joel Dearden for Figures 1-6 and 10-12 and to Andy Bevan for Figure 9.

"The arts and humanities are not luxuries; they are not optional extras that can be dispensed with when times are tight. They are what define us as civilised human beings."[2]

Or, Martha Nussbaum on the humanities and public policy:

One thing my development work has shown me is that public policy made without the influence of the humanities is likely to be cramped and crude. The cultivation of the imagination that comes with the study of literature, the cultivation of ethical sensibility that comes with the study of philosophy and religion – these are essential equipment for citizens and policy makers in a world increasingly united and driven by the profit motive.[3]

There is an argument from business. Dr John Seton of BT:

Successful and compelling services are not just about technology; we also need to understand the personal, social and cultural contexts of our customers much better than we do.[4]

The argument for both the humanities and the social sciences is about understanding ourselves and the societies we live in. This kind of knowledge differs from that of the physical and biological sciences because we are participants: we can create ourselves within the limits of the political systems and processes that we live with. We can imagine, and seek to achieve, alternative futures. The arts are critical here. As Jude Kelly remarked

"Art is the muscle of the imagination". [5]

We have to be creative in different ways to achieve the depth of understanding that is our ambition. That is what research in the humanities and social sciences is about.

IMPACT

All of that is what I am going to take as given. I also want to say something at the outset about 'impact'. The humanities and social sciences share the core argument that we should have the depth of understanding I have talked about and that research in these territories is worthwhile. We now have to justify this is economic terms for the Treasury. As it happens, in one sense at least, this is easy to do. In the case of arts and humanities, the sheer scale of the 'industry' provides the justification: 500,000 undergraduates, 25% of the research-active academic staff in universities, 2.8% of the research funding. But this particular part of the industry also attracts 80,000 overseas students worth between £2-3Bn in the economy. The AHRC's annual budget of around £120M surely supports a good fraction of that, by supporting the world-class research base that we have in this country, and so repays in economic terms in abundance. It underpins, in other words, a major export industry. Much research in the humanities, of course, has direct uses for the Foreign Office, the Home Office, Communities and Local Government and many other arms of public policy. The social

[2] Private communication to AHRC

[3] AAU Centennial meeting, Chicago, 2000; quoted in Wilson, A. G. (2010) *Knowledge power*, Routledge, London and New York.

[4] Private communication to AHRC

[5] Convocation Lecture, University of Leeds, June 2001.

sciences have a more direct impact in both the commercial world and on public policy and I will elaborate this argument later. [6]

But we should be encouraged by the fact that Ministers in the Coalition government rise above simplistic ideas of impact. David Willetts, while arguing that intellectual enquiry is worthwhile for its own sake, quoted David Hume:

"An advantage of industry and of refinements in the mechanical arts is that they commonly produce some refinements in the liberal; nor can one be carried to perfection without being accompanied, in some degree, with the other. The same age, which produces great philosophers and politicians, renowned generals and poets, usually abounds with skilful weavers and ship-carpenters. We cannot reasonably expect that a piece of woollen cloth will be wrought to perfection in a nation which is ignorant of astronomy or where ethics are neglected."[7]

Similarly, Vince Cable. I quote again:

"…….what my father used to describe as 'arty farty' subjects feed into the rapidly growing and successful industries like creative design, publishing and music. Many employers simply want people who can think clearly, which is why the study of philosophy or history or classics is a lot more than an interesting diversion. An essentially utilitarian take on universities doesn't mean philistinism."[8]

CHALLENGES AND OPPORTUNITIES: TOWARDS INTERDISCIPLINARITY.

If we can accept the core argument that the humanities and the social sciences are both important and valuable, we can then ask the interesting question: what are the new challenges and opportunities when we find ourselves in an intensely technological era?

I am going to argue that a key element in responding to this era is interdisciplinarity. This is one of the greatest of the challenges we face because we have a long way to move from where most institutions are now. We have to move beyond what Jurgen Mittelstrass called – in attempting to open the door for the humanities into the European Research Council - the "trend to isolation". I quote:

"The estrangement that emerged between the natural sciences, the humanities and the social sciences in the course of the development of modern academia repeats itself on a smaller scale between the various disciplines in the humanities."

To further emphasise the scale of the challenge, he also speaks of "***intra****disciplinary isolation*" and that "*suddenly Babylon is everywhere in the humanities*".[9]

We have to respect what can be achieved in the major disciplines, what we can learn from their traditions, but also note the dangers. In History and English, for example, with a fixed amount of material, could we be encouraging graduate students to work on narrower and

[6] See AHRC (2008) *Leading the world.*
[7] Quoted by David Willetts in a speech in Birmingham in May, from David Hume's essay 'On refinement in the arts'.
[8] In a speech on 15th of July 2010.
[9] See Report of Academia Europaea Meeting, Oslo, June 2005.

narrower topics: what Trevor-Roper as long ago as the 1950s was referring to as 'monastic laundry lists'[10], or obscure authors who are obscure for good reasons? The technological age offers new opportunities in these territories for research of greater ambition.

In the social sciences it is easier to chart these new territories for the simple reason that there are so many grand challenges for all governments that are essentially social science research questions. But again, 'ambition' becomes the key word. The bulk, though not all, of the new opportunities demand interdisciplinary thinking: approaching problems from first principles and bringing all possible concepts and theories to bear. Indeed, we should also emphasise the opportunities for interdisciplinary collaboration across the humanities-social sciences divide, and I will demonstrate some possibilities in this respect later.

This interdisciplinary thinking should obviously embrace the opportunities offered by new technologies. So the next question to ask is: what's new?

WHAT'S NEW?

What does technology bring to the party? To start with, of course, a new kind of society to study and to explore: micro-manufacturing and nano-engineering, e-business, the globalisation of the economy – and endless list. There are many specifics in academia in terms of the application of technology, such as the science of forensic archaeology for example. But the overwhelmingly most important must be computing power and the internet. The first is important for both the humanities and the social sciences - offering virtually infinite data storage along with capabilities for retrieval and visualisation. Archives and facsimiles can be digitised, stored and systematically and intelligently searched. Given these technical capabilities, more hitherto hidden or expensive data sources are becoming available – not least from public sources through the Tim Berners-Lee-Nigel Shadbold initiative. There are also rapidly expanding sources of commercial data: banks, telecoms companies and retailers for example now hold previously unimaginable amounts of information on all of us. This must transform history as a discipline in the future and has all sorts of implications for priorities in contemporary social science research. The data and the associated computer power enable computer models to be built which were infeasible only a few years ago.

More broadly, 'knowledge' can be stored digitally and the likes of Google and Wikipaedia enable us to access it systematically – up to a point. There remain problems to be solved from the limitations of copyright on the one hand to the serious research challenge of designing intelligent search engines on the other. All of this has massive implications for both teaching and research. The issues of interdisciplinarity, and what I will call 'requisite knowledge', are exposed by the challenges of intelligent search. This is the contemporary version of the library classification problem and I always remember a remark made in a seminar in my student days - that the library classification problem was roughly of the same order as the task of the machine translation of languages - though the Google company

[10] Sisman, A. (2010) *Hugh Trevor-Roper: the biography*, Weidenfeld and Nicholson, London

might argue that it is en route to solving that problem – though through brute force rather than through elegant algorithms.

The idea of 'requisite knowledge'[11] is this: for any given problem, whether for a researcher with something new, or a student seeking some understanding, what is the set of relevant knowledge that can be assembled? Some of this will be knowledge in depth which, at the present time, is likely to come from within a discipline. It will involve concepts and theories that are beyond a simple internet click. Some of it will come from much further afield. Interdisciplinarity is about a preparedness to seek to assemble the requisite kit in any particular circumstances. I think we are a long way away from this mindset. However, we can certainly begin, and we can find many examples which already illustrate future potential. I am going to pursue two kinds of example: new developments in academic research; and examples with direct application both in industry and in public policy.

NEW DIRECTIONS.

At an elementary but important level, there is the possibility of making massive data sources available on line – with all the associated search facilities that accompany this. This is happening. The British Library newspaper archive is an obvious example, or the King's project on the fine rolls of Henry III[12]. This enables scholars to make much more of the 'fixed material'. This can be taken further by linking different sources of material. There is a fascinating Scottish project on 12th Century prosopography which involves looking for common names in different records and linking them.[13]

With this new material, we begin to have the possibility of new kinds of analysis. How are we responding? A conjecture: the 'technical' is currently running ahead of 'depth of understanding': we have fantastic data bases and means of display but we don't typically have the corresponding depth of analysis. However, this is where the opportunities of interdisciplinarity kick in: we can begin to overcome what Mittlstrass called '***intra***disciplinary isolation'. The methods and insights of history, econometrics, mathematical economics, behavioural economics, urban studies – whatever is appropriate - can be brought to bear on both old and new challenges. We are recognising that many research problems are illuminated by a systems perspective – the high degrees of interdependence and, particularly in social science modelling, of the interesting features that arise from nonlinearities. We are recognising the complexity of our systems of interest – and that takes us into a part of the new scientific mainstream of 'complexity science' - now a priority field for many of the research councils. And so what might be thought of as 'hard' science – technology if you like '- has a direct offering for humanities and the social sciences. To fix ideas further, let me present a number of examples, each related to my own field of cities and regions.

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[11] See Wilson, *Knowledge power, op. cit.*

[12] D Carpenter, AHRC project: The fine rolls of Henry III, 1248-1272.

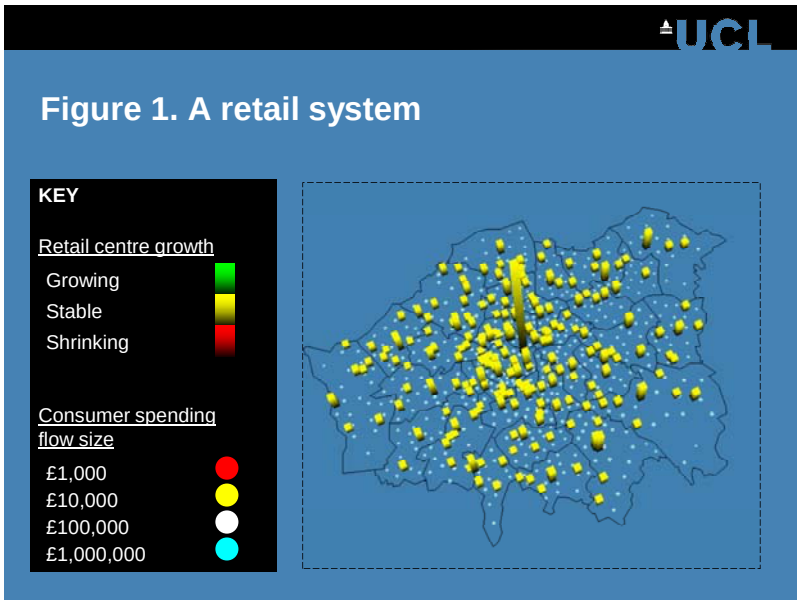
[13] D Brown, AHRC Project on Data base of Scots individuals, 1093-1286.

Cities and regions are complex systems of interest and almost all disciplines have some bearing on their study which therefore represents the essence of interdisciplinarity.[14] Novels are written about cities, artists paint them, urban history is a major subdiscipline as is urban and regional economics – or regional science. There are important areas of application in both business and the provision of public services. The spatial structures of cities and regions, and the ways in which these evolve, have long been an important part of geography. My own interest has been on the major subsystems – the demographic, the economic and the flows in the city – of people, of goods and services, of money. We have reached a stage where we are pretty good at building mathematical and computer models of how a city or a region works and we are perhaps on the edge of an understanding of the longer term processes of evolution.

Let me begin with an urban retail system as a contemporary example. Mathematical and computer models can be developed which work, for contemporary analyses, very well and they form the basis for beginning to meet one of the big research challenges of my field: giving an account of how cities and regions evolve over a long time period; and what any such understanding implies for future policy and planning. This is the social science equivalent of developmental biology. The models are rooted in the social sciences – geography and economics - but incorporate insights from physics and ecology.

An example of a system of interest is shown in Figure 1.

Figure 1. A retail system



This is modelled by the spatial interaction equations shown in Figure 2.[15]

[14] See Wilson, A (2000) *Complex spatial systems*, Prentice Hall.
[15] The model results that follow are described in Dearden and Wilson (2011) A framework for exploring urban discontinuities, *Geographical Analysis*.

Figure 2. Retail model – flows: fast dynamics

Figure 2. Retail model – flows: fast dynamics

$$S_{ij} = A_i e_i P_i W_j^{\alpha} e^{(-\beta m_j c_{ij})} \quad A_i = \frac{1}{\sum_k W_k^{\alpha} e^{(-\beta m_j c_{ik})}}$$

- S_{ij} : consumers living in zone i and shopping in zone j
- e_i : average income in zone i
- P_i : population in zone i
- W_j : retail floor space in zone j
- α : impact of retail zone size on consumer decisions
- β : impact of travel cost on consumer decisions
- c_{ij} : travel cost from zone i to zone j
- m_j : public transport multiplier for zone j

These equations are derived using methods from statistical mechanics - invented by Ludwig Boltzmann in the late Nineteenth Century. Note that it took many decades before it became recognised that these methods could be viewed from a higher level of generality and had applications in many fields.

The display of results shows what can be achieved with contemporary computer visualisation - see Figures 3 and 4.

Figure 3. Flows out....

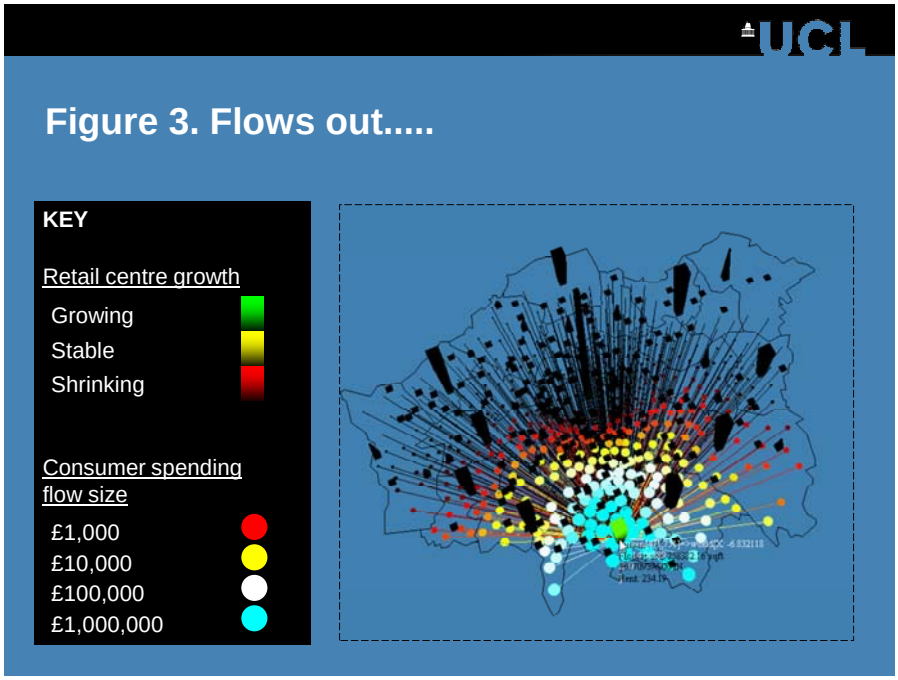
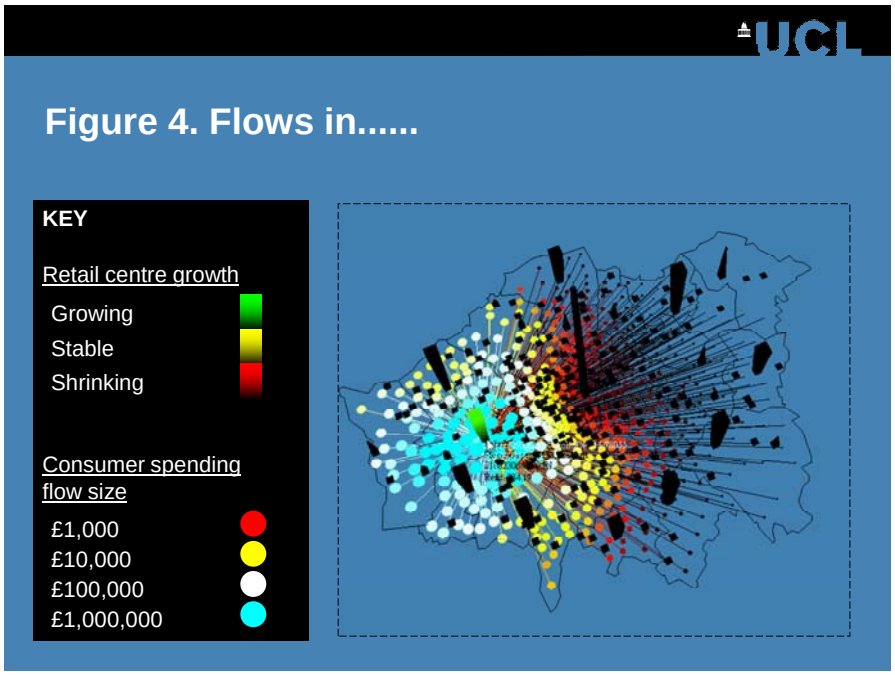


Figure 4. Flows in....



We can note in passing that this example of an academic development has significant commercial applications. The models can be built with much more detail and it is possible to use them to optimise the location of retail facilities. These applications led to the formation

of GMAP Ltd in 1991[16] and the methods are now used routinely by major retailers and, for example, banks, to optimise their networks. It is intuitively clear that these methods can also be applied to public facilities but this is an opportunity yet to be extensively developed.

The ongoing and more difficult research challenge is to model the evolution of cities. In the case of the retail system, a core hypothesis is shown in Figure 5.

Figure 5. Retail model – the slow dynamics

Figure 5. Retail model – the slow dynamics

$$\frac{dW_j}{dt} = \varepsilon\left(D_j - KW_j\right)$$

- ε : rate at which retail zones respond to profit levels
- D_j : total income of retail zone j
- K : costs per m^2 in retail zone j
- W_j : retail floor space in zone j

In essence, this simply states that if a centre is profitable, it will grow, and vice versa. The hypothesis is formulated in terms of the basic economics, but the equations can be recognised as those developed independently by Lotka and Volterra in ecology in the 1920s. Again, it has taken decades to recognise their wider applicability. When these equations are unpicked, they are seen to contain nonlinearities, and what is particularly interesting in this case, is that they show positive returns to scale – something property developers have long recognised intuitively! The revenues in these equations are estimated from the flows and so we have in effect combined Boltzmann and Lotka and Volterra and so they can be called BLV models.[17]

The important next step in this argument is to outline what we can learn in general for our disciplines – humanities included as we will see – from the theory of nonlinear systems:

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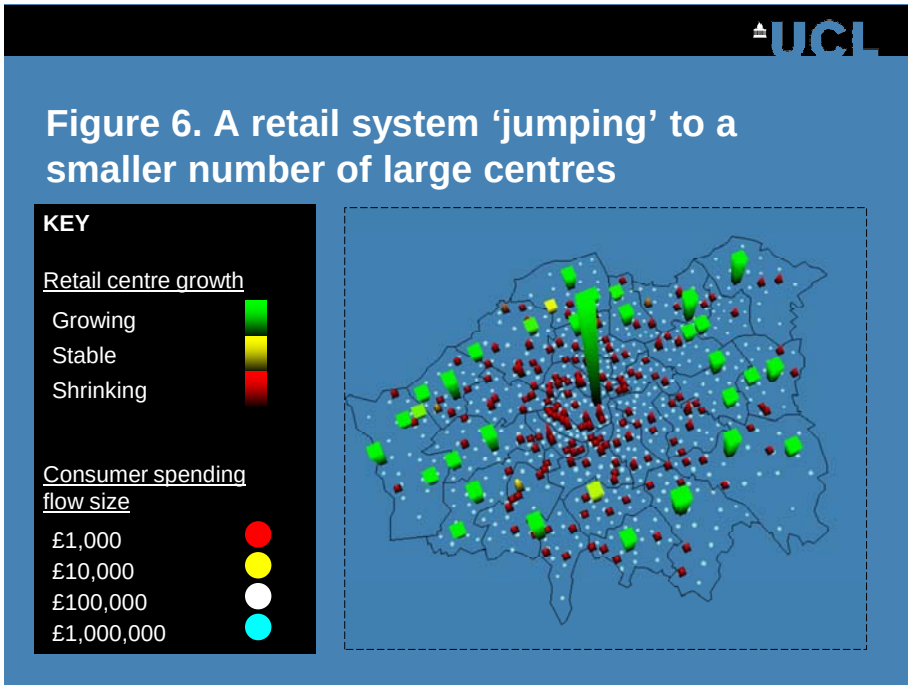
[16] Birkin, M., Clarke, G. P., Clarke, M. and Wilson, A. G. (1996) *Intelligent GIS: location decisions and strategic planning*, Geo-Information International, Cambridge

[17] The argument is summarised in Wilson, A. (2008) Boltzmann, Lotka and Voloterra and spatial structural evolution: an integrated methodology for some dynamical systems, *Journal of the Royal Society, Interface, 5*, 865-871.

what this theory tells us about forecasting for example. There are three properties of such systems that we always need to have in mind: the possibility of multiple solutions – *multiple equilibria*; this means that any particular solution is determined by the initial conditions and if we think of a sequence through time as a string of 'initial conditions', this leads us to the notion of *path dependence*; and thirdly, there is the possibility of an abrupt change from one kind of structure to another at some critical values of the system's parameters – what physicists would call *phase transitions*. I will concentrate on phase transitions and path dependence.

A dramatic and real enough example, for those who are old enough to remember, is the transition in the late 50s and early 60s in food retailing, from corner shops to supermarkets – essentially brought about by shifts through critical points of particular parameters in the model – and in real life! – that related to income and car ownership.[18] The identification of other phase transitions – gentrification in inner city areas might be another example – is an important research question.

Figure 6. A retail system 'jumping' to a smaller number of larger centres



But let me extend the ideas to path dependence. In effect this means that the short run future of a city, for example, at any given time, is largely determined by the existing structure and this is intuitively sensible. It is instructive to think of the variables that

[18] Wilson, A. G. and Oulton, M. J. (1983) The corner-shop to supermarket transition in retailing: the beginnings of empirical evidence, *Environment and Planning, A, 15*, 265-274.

constitute the description of this structure in a mathematical model as the 'DNA' of the system[19] and this leads to the idea of possibility cones[20].

It is worth noting at this point that there is a lot of fashion in research and in urban modelling this connects to the broader ideas of complexity science, and ideas like emergence; but it is also about different modelling approaches and a good topical example is agent-based modelling. The key idea here is to have a population of agents who are assigned rules of behaviour and then to allow them to interact according to these rules. It is my own intuitive belief that when there are competing styles of modelling the same system of interest, there will usually be something in common at a greater depth. So, with a colleague, I created a pool of retailer agents and gave them rules based on the probabilities that can be derived from the BLV models. The results are shown in the next series of figures.[21]

[19] Wilson, A. G. (2010) Urban and regional dynamics from the global to the local:'DNA' and 'genetic planning'. *Environment and Planning, B, pp..*

[20] Wilson, A. G. and Dearden, J. (2010) Exploring the possibility cone of urban development, Working Paper 157, Centre for Advanced Spatial Analysis, University College London.

[21] Wilson, A. G. and Dearden, J. (forthcoming) Tracking the evolution of regional 'DNA': the case of Chicago, in Clarke, M. and Stillwell, J. C. H. (eds.) Understanding population trends and processes, Springer, Berlin..

Figure 7. The study area

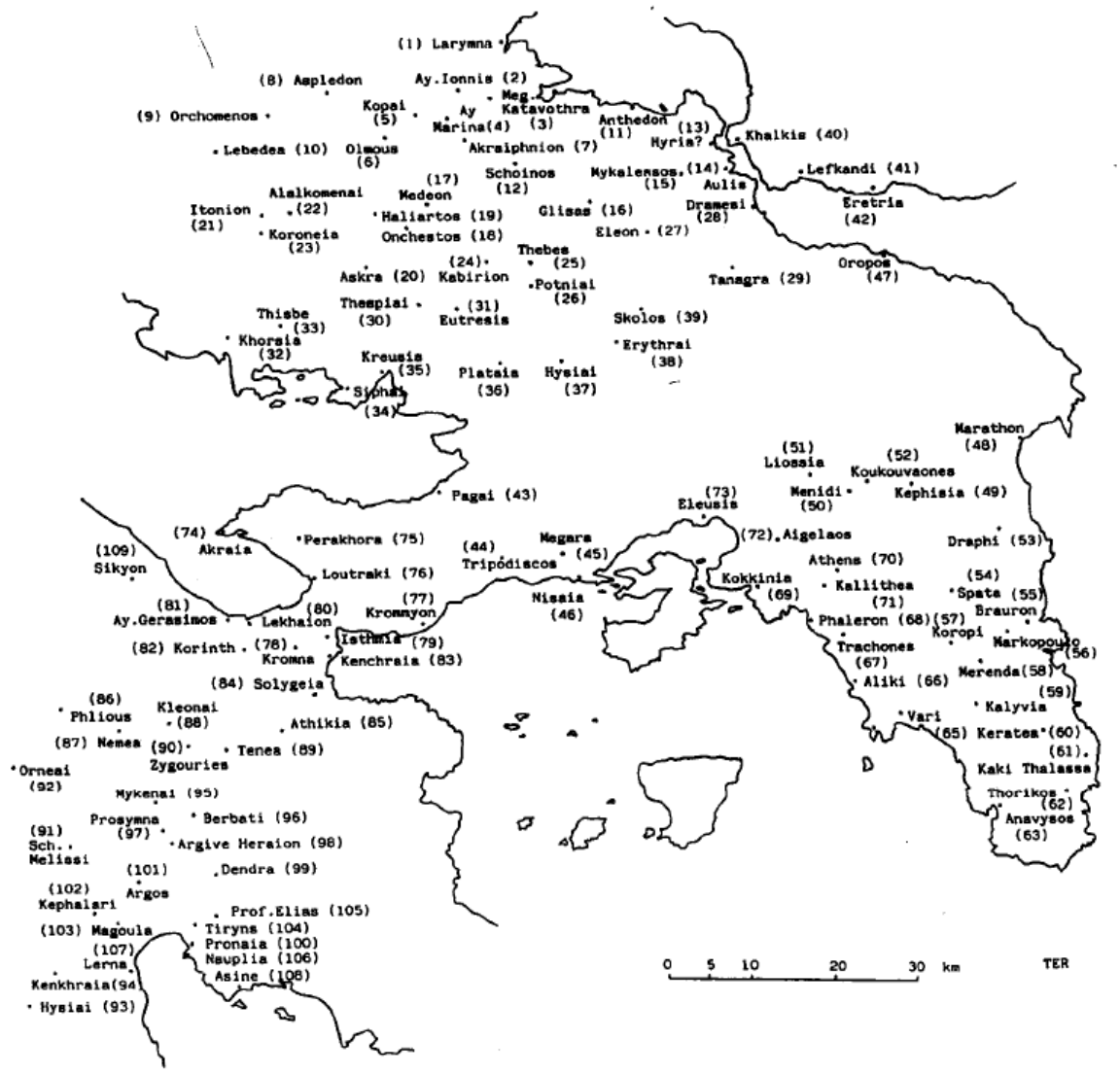
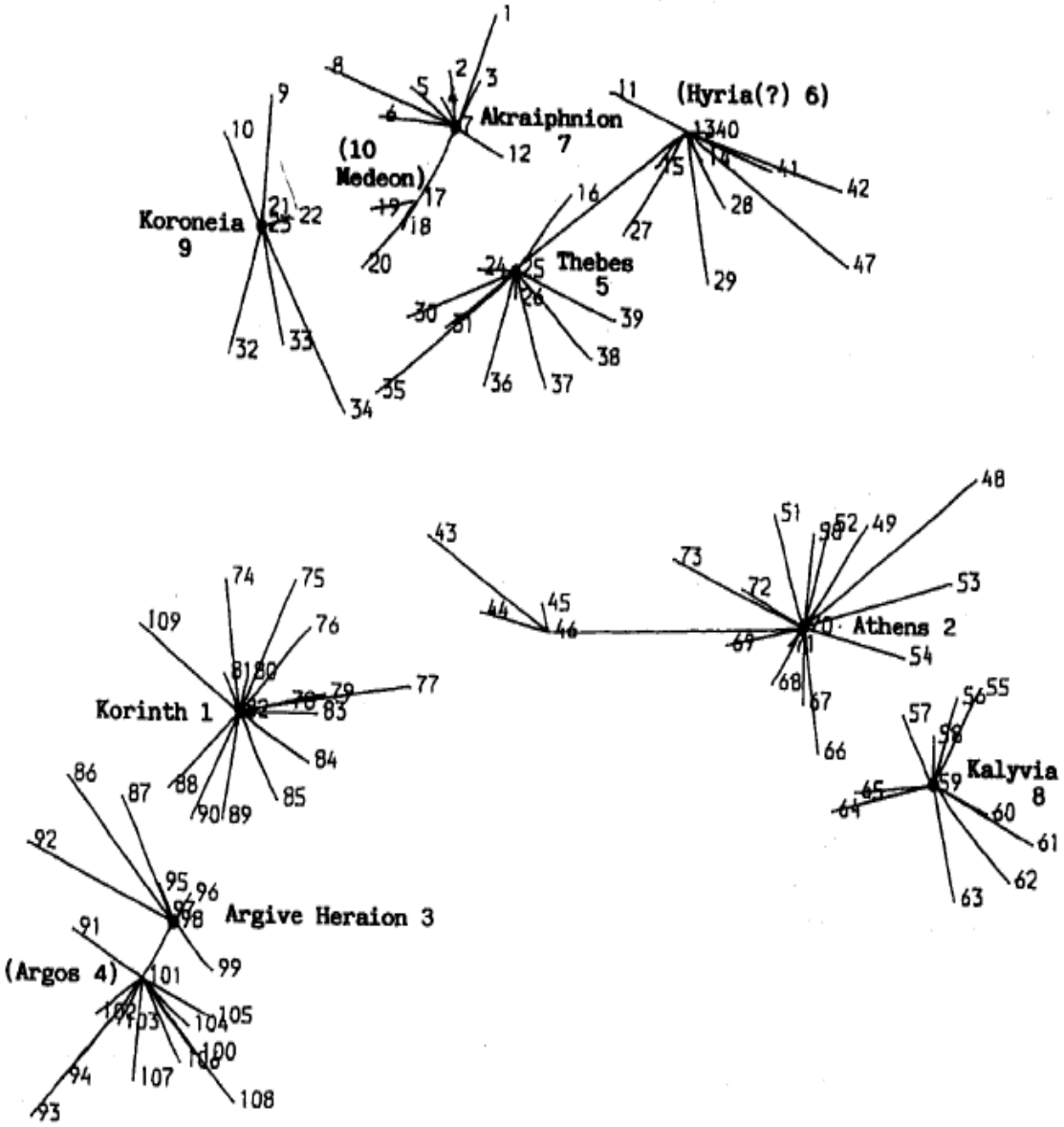


FIGURE 1

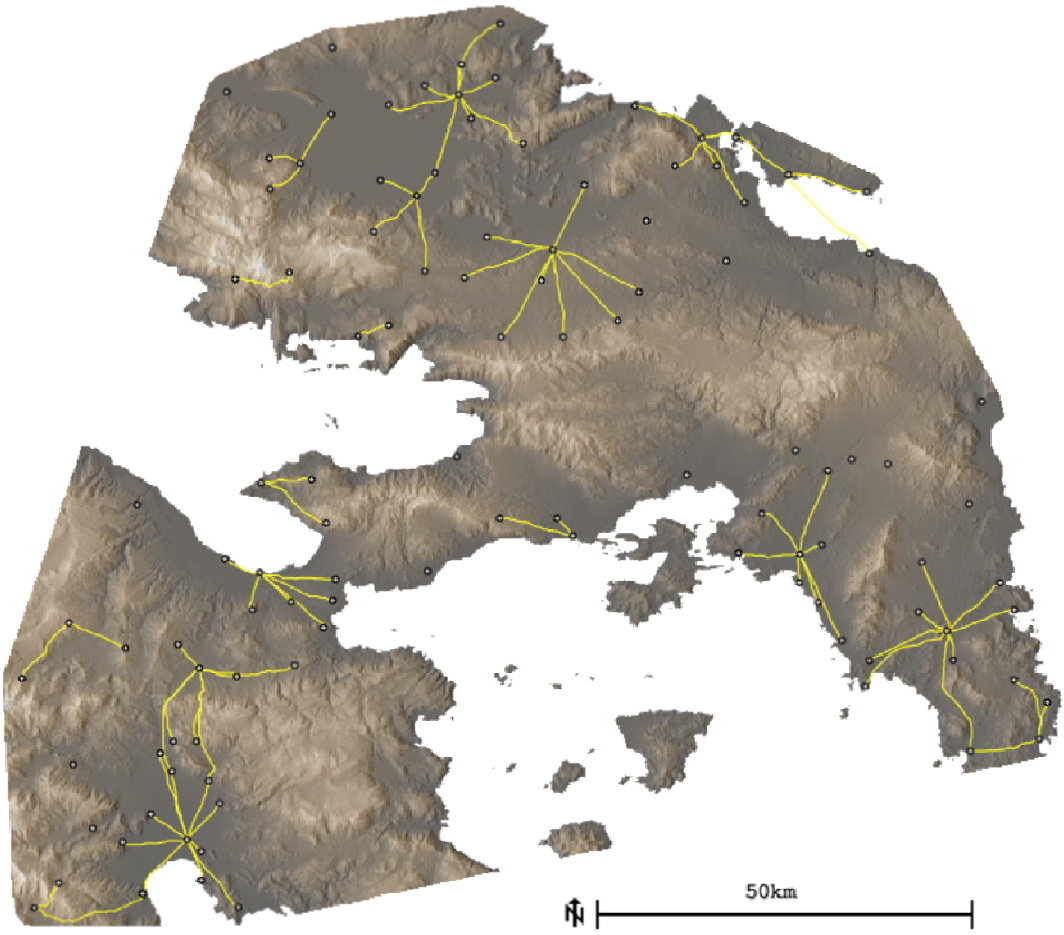
Figure 8. Identifying clusters



* FIGURE 2

Eight systems (with topographical weightings).
$\alpha = 1.01$
$\beta = 0.15$
Maximum flows only depicted.
* In all figures the number is the predicted rank of a named site.
High ranking but non-terminal sites are given in brackets.

Figure 9. Emerging structures



Let me then return to BLV models and to widen the range of application. To illustrate the kind of jump that is possible in academic terms, let me leap from contemporary urban geography to examples from archaeology. In the late 1980s, I did some work with Tracy Rihll on urban structures in Greece in the Ninth Century BC.[22] Tracy had point data on settlements but nothing on relative sizes and someone suggested to her that what I am now calling BLV models might illuminate this problem. See Figure 7.

The i's and j's in the model can now be taken as settlements and the interactions a combination of trade and migration. It is then possible to start with 'all settlement sizes equal' – that is, all the W_js equal – and to seek an equilibrium from the dynamic equations. One set of results is shown in Figures 8 and 9 (representing 1980s visualisation and 2011 visualisation!).

This is an elementary network analysis to show the hierarchical structure that emerged – and it is interesting that the main central places include Athens, Corinth and Thebes. These

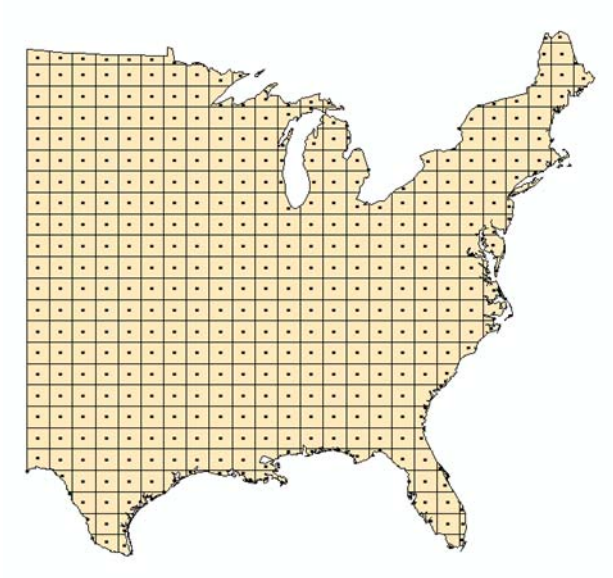
[22] Rihll, T. and Wilson, A. G. (1987) Spatial interaction and structural models in historical analysis: some possibilities and an example, Histoire et Mesure II-1, pp 5-32.

central places were all well known to archaeologists bar one – and I suspect it remains an open question as to whether a major dig should be launched there!

This work has recently been picked up by some American researchers[23] and this has led to some new explorations on Middle East and Mediterranean data, including work by Andrew Bevan and myself in UCL – and the more recent figure is his. What this illustrates, in a more general sense, is that models can help to solve 'missing data' problems – and this is likely to be very helpful in archaeological and historical contexts.

My final example takes us beyond equilibrium analysis to attempt to model real dynamics: the evolution of the United States regional system from 1790-1870, the period chosen because, first, there was good census data on urban populations and second, we were particularly interested in the impact of railway development on the mid-West.[24] The study area is shown in Figure 10.

Figure 10. The USA study area



- Population data at county level from historical census (1790 to 1870) – source: NHGIS (www.nhgis.org)
- County boundaries change each decade
- Aggregated to a regular grid
- 434 cells
- Aggregated "settlements" are grid square centroids

We represented the transport system by a spider network with land, water and rail as they key modes – see Figure 11.

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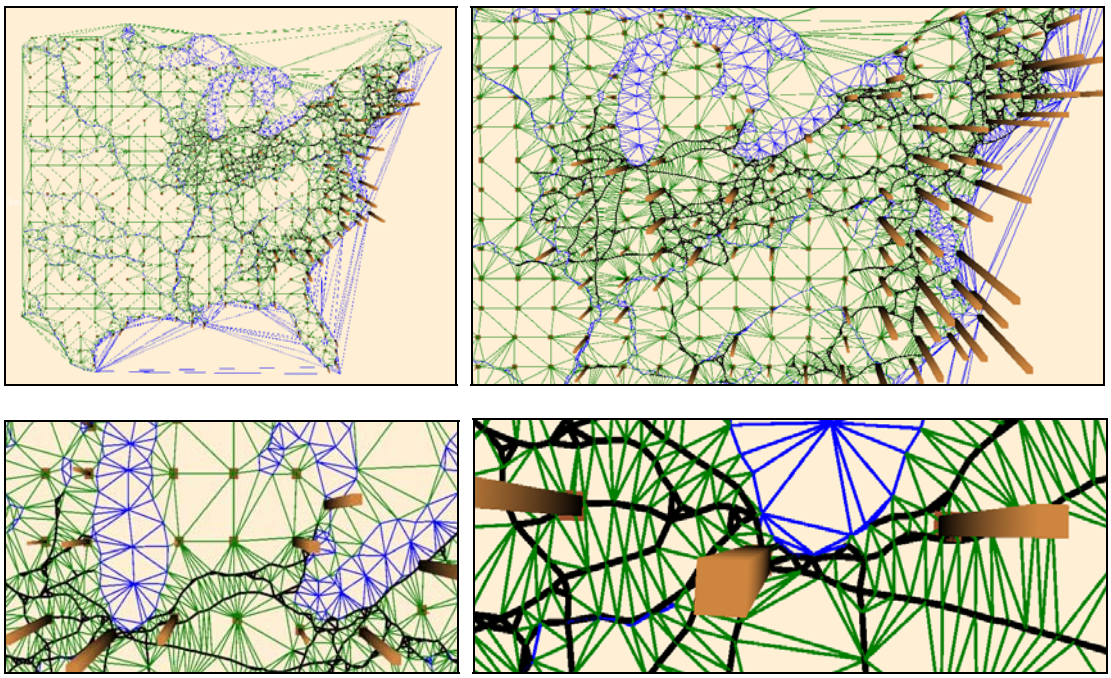
[23] Graham, S, and Steiner, J. (2008) Travellersim: growing settlement structures and territories with agent-based modelling, in Clarke, J. T. and Hagemeister, E. M. (eds.) *Digital discovery: exploring new frontiers in human heritage. CAA 2006. Computer applications and Quantitative Methods in Archaeology. Proceedings of the 34th Conference*, Fargo, United States, April 2006.

[24] This is written up in Wilson and Dearden (op. cit.)

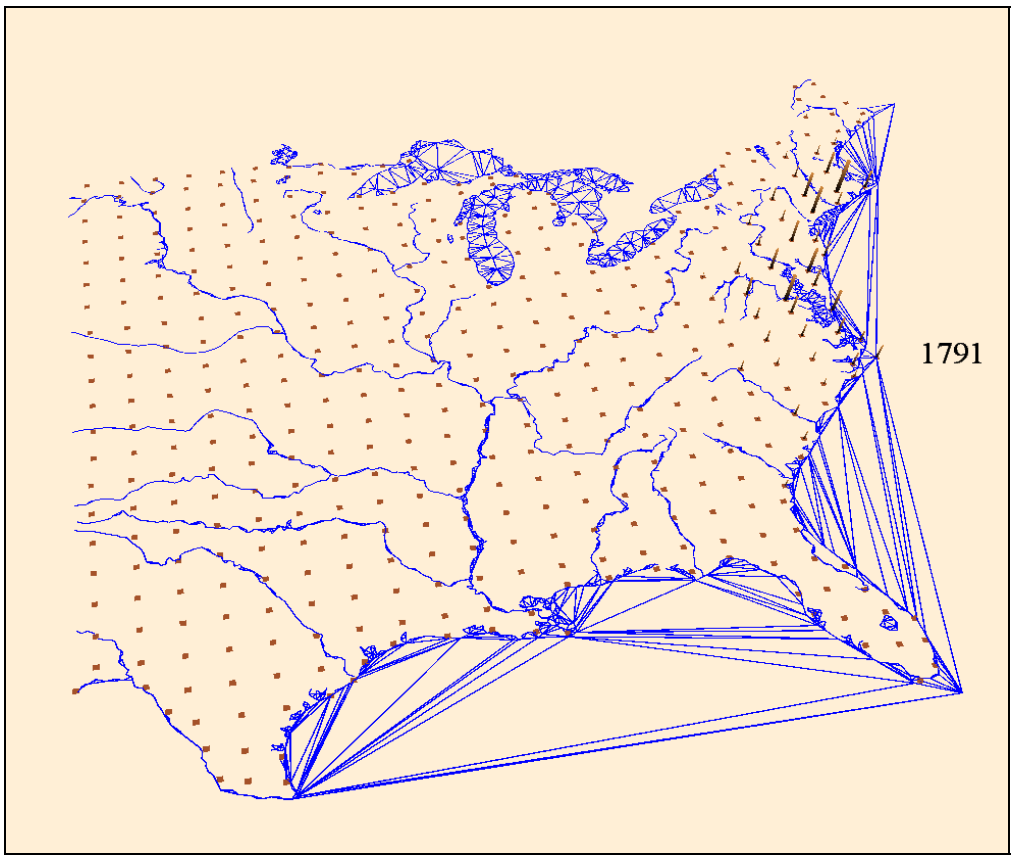
Figure 11. Spider networks.



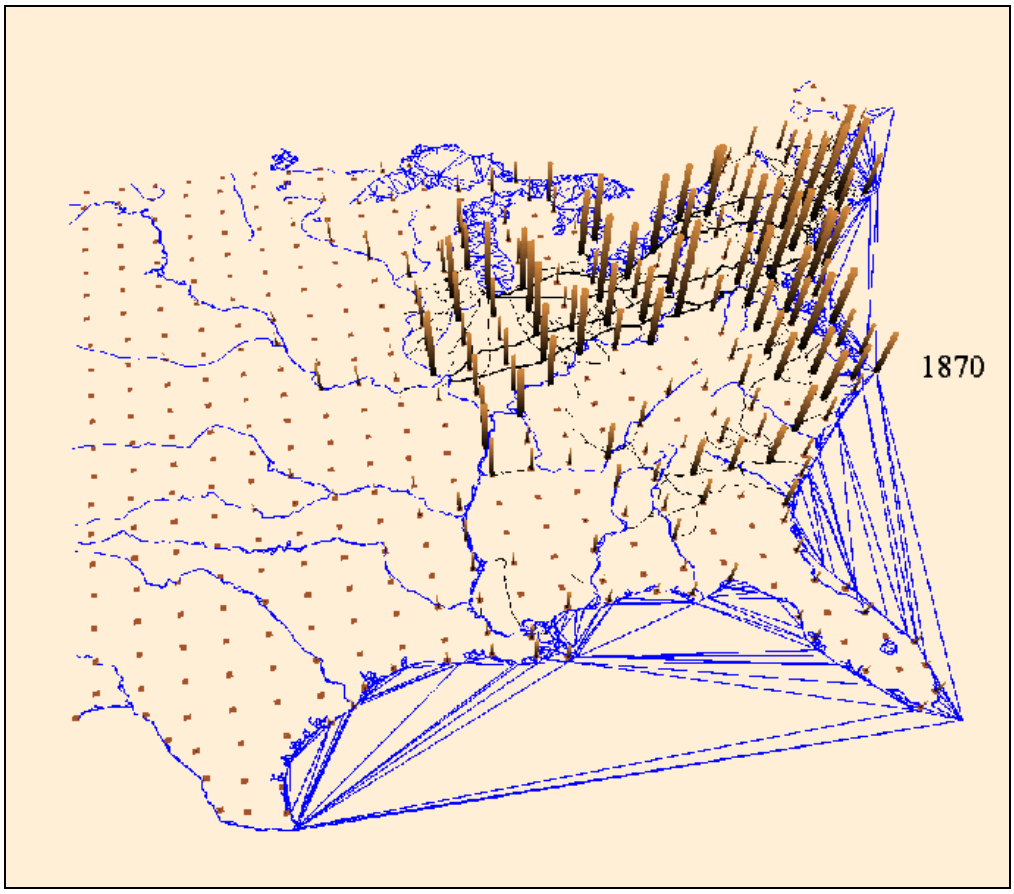
We interpreted the equations of the model, as in the Greek case, in terms of trade and migration – the former being particularly important for the mid-West in terms of grain, meat and timber – with, of course, reverse flows of consumer goods from East to West. The results are shown in Figures 12 (a) and (b).

Figure 12. The evolution of the USA urban system.

a. 1791



b. 1870



I trust these examples have shown the power of interdisciplinary approaches to challenging research problems. These particular methods apply to a wide range of problems. The trick is to recognise the system type. Weaver[25] hit the nail on the head as long ago as the 1950s in characterising problems – or systems – as simple, of disorganised complexity and of organised complexity. For urban and regional systems, this is a new way of doing economics, though not one that is yet popular with economists! This illustrates the relative isolation of disciplines from each other.

There is a teaching challenge that is exposed by this kind of analysis. In my examples, I use ideas and material from physics, ecology, geography, economics, archaeology and history. At what point in a student's career can we show that this kind of breadth, alongside traditional disciplinary depth, is important?[26]

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[25] Weaver, W. (1958) A quarter century in the natural sciences, *Annual Report, The Rockefeller Foundation*, New York, pp. 7-122.

[26] Wilson (2010) o*p.cit.*

PUBLIC POLICY

Consider the following list of public policy issues – by Government department.[27]

- Health: what is the proper balance of primary, secondary and tertiary facilities – taking into account the balance between efficiency, effectiveness and accessibility? Or for primary: how should the network of GP practices be organised?
- Education: what is needed in terms of supply and location for a 'parental choice of schools' policy to work (in England)?
- Social care: from looked after children to care for the elderly and infirm.
- Work and Pensions: benefits and pensions in the longer term?
- Business, innovation and skills: funding FE Colleges and universities.
- Home Office: police, migration, security.
- Justice: the scale of funding for rehabilitation programmes for prisoners versus increases in the prison population.
- Communities and local government: what is the planning system for? The future of council and social housing.
- Transport: the big infrastructure questions.

This is a far from comprehensive list and it already indicates the problem of Government departments functioning in silos. As a list of policy issues it is inevitably also a list of political issues. I would argue that to approach these issues, we need to decompose them into three areas: the specification of the policy objectives, the design or invention of solutions and the analysis of how different kinds of solutions would work. Social science has a part to play in all three areas but there is perhaps a spectrum with the political having a bigger role at the policy end and the social science at the analysis end. What is clear to me is that we often fail in the invention phase by not exploring a sufficiently wide range of alternatives; and we spectacularly fail at the analysis end of the spectrum. This is where the social sciences have, potentially, a substantially increased role to play. These are issues where virtually every part of your new Faculty has a role to play.

Let me make some more specific comments on this agenda. A review of my examples soon shows that many are rooted in the 'location of facilities' issues and systematic analysis would be possible using the methods I have outlined in relation to retail. The other common feature, not surprisingly since we are here concerned with *public* policy, is the need to model and track populations with various characteristics: consider morbidity, progression through the education system, take up of benefits and pensions (in relation to employment and skills), progression through the criminal justice system, accessibility issues. Organised intelligence on these would much better inform the development of public policy. And perhaps almost as important, this kind of analysis would expose the interconnectedness of

[27] Wilson, A. G. (2008) Science and the city, *Environment and Planning, A, 40*, 2800-2808.

issues between government departments. In some ways, this is an elementary kind of research, but in general, it is not done, and certainly not in a linked way. We are a long way short of joined up government, but we are also a long way away from joined up research.

Let me offer some conjectures. Many problems are linked to income. Lack of income is strongly related to performance in the education system. What are the roots of these problems in communities where schools are not producing leavers with any qualifications? Why are looked-after children particularly badly served – and make up quite a large proportion of the prison population? This takes us far beyond technical analysis of course, but it exposes the problem. It invites a wider search for alternative solutions. It is open to different kinds of social science analysis.

The technical foundations – whether it is optimising the location of facilities or assembling the population data bases - could be put in place, but typically, are not. In other words, the technology – in data, models and software senses – is already available but is not used. I would argue that this is not a matter of lack of resources in Government but a failure to marshall the available resources in the most effective way.

WHAT CAN BE DONE?

The challenge for Government is to find a way of concentrating its social science resources on the most important issues; it is failing to do this at present. 'Social science' in this context embraces all of the rather fragmented professional disciplines in the civil service – economics, operational research, statistics, science, social research and perhaps more. It also connects to an earlier part of my argument: it would have to be truly interdisciplinary: economics in Government, for example, is not strongly connected to the other disciplines. A concentrated resource would demonstrate that social science in the public policy context was necessarily 'big science' – indeed what I have previously called a 'CERN for the social sciences'.

What can universities do? What can a Faculty of Humanities and Social Sciences, functioning in the context of new technologies do? What it can't be is the CERN for the social sciences. What it can be is ambitious, ensuring that the big issues are on the research agenda and then to explore them, with all the resources the new technological environment can offer, on a proof-of-concept basis. We shouldn't be put off from working on the big issues by the scale of the research resources available to us.

All of this should be in the context of our core values. All of it should build on what is achieved in particular disciplines. But we must recognise that many of the major research questions for the future are fundamentally interdisciplinary and we need to find ways of responding to this agenda. We have fantastic, interesting and important research opportunities open to us and I believe, with your new Faculty, you are in a strong position to respond – all within the important Strathclyde ethos of 'useful learning.