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Coming home; a personal re-evaluation of the aspirations and utility of Integrated Assessment.

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Abstract

The early phases of any new initiative are exciting times, full of enthusiasm, anticipation, and promise. Whilst the field of Integrated Assessment (IA) retains many of these features, it is now, as an intellectual project, moving into maturity and middle age; an appropriate moment, perhaps, for reflection and self analysis. In presenting a personal view of the ambition and application of IA, this contribution adopts a very simple compositional structure which allows us to present a dialogue between objectives and practice. It is a revised version of a paper delivered to the EFIEA/TIAS conference in Berlin in February 2005 and is informed by the debate conducted following its presentation.[1] Following a review of why we conduct IA and some of the attendant practical challenges, the text goes on to describe an example of IA research in the field of water management. Conclusions reflect on the role of IA in the context of contemporary developments in theories of knowledge creation and socio-natural systems management.

Keywords: Integrated Assessment, Theory, Process, Practice, Water Management

1 The Nature of Integrated Assessment

Before embarking on the central subject matter of this essay, a few words of qualification and intent are called for. The broad ambition of the following text is to encourage IA practitioners to explore and evaluate the nature of their scientific contribution. There is a history of debate on the nature and substance of IA (see, for example, Rotmans and Vellinga, 1998; Toth, 2003) which this paper seeks to extend rather than replace. The style is argumentative and the content replete with hypothesis and theory. The text poses far too many

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[1] Where I have used concepts or comments articulated during the conference or taken from reports on the procedings, I have used quote marks and a reference to 'EFIEA/TIAS, 2005'

questions and provides robust answers for precious few of them. The insights put forward are founded on experience and critical reflection. It is, therefore, very much a personal observation or study; enlightened and emboldened by dialogue with colleagues and friends, but darkened by the constraints of time and limits of understanding. And so, on to the substantive matter to hand.

Undergraduates are prone to be overly impressed by simple but well formulated insights. Yet, whilst we come to recognise the emptiness and intellectual dishonesty of some of these aphorisms, there are others which remain impressive for their succinctness and lastingly influential. One such quote has accompanied me for some twenty years now and I find its relevance emphasised by daily experience. The observation that 'the world's problems do not come in disciplinary shaped boxes' was made to me by a lecturer on one of my undergraduate courses and it continues to pose an intellectual and professional challenge. Whilst many writers (from both academia and politics) have made the same observation in other ways, the fundamental question of why the organisation and management of those activities intended to help communities solve their problems should be structured in a way incommensurate with that of the problems themselves, still keeps me thinking.

Significant progress has, of course, been achieved in bringing the largely disciplinary structures of our universities and research centres into closer alignment with the needs of commerce, industry and the public sector. Research funders are now more adept at articulating their needs with regard to social and economic value. Similarly, researchers increasingly recognise the benefits of working closely with problem owners and solution beneficiaries. Our universities are home to increasing numbers of research centres which draw on expertise and knowledges from across the disciplines and professions to focus on a specific sector or theme. Momentous advances have, for example, been made in the fields of medicine and manufacturing through the union of hitherto remote disciplines. So how does the Integrated Assessment community fit in to this picture of increasing interdisciplinarity?

The types of topic of central interest to most (though by no means all) of TIAS membership could perhaps be summarised by the term Environmental and Natural Resource Management. Endeavours in this area are characterised by a number of features which make 'Integrated Assessment', in its broadest sense, particularly difficult:

1. Research is typically problem driven and policy relevant; it is motivated by a current or anticipated predicament and not by an opportunity or the desire just to see what happens

2. Contributions from the social and/or human sciences are obligatory

3. The typical spatial scales at which analysis is conducted represents a high level of aggregation; relating to states, regions or occasionally the earth.

As a direct consequence, the types of problems which we address often have no single answer that is definitively known to be correct. Answers depend on

how the problem is construed by the actors who, even when they agree about how to interpret the issue and specify the problem, subscribe to different analysis and solution options. Ackoff (1974) describes such 'messy' problems as sets of circumstances in which there is extreme ambiguity. Rittel and Weber (1973) put it more bluntly and call them "wicked problems".

I make no apologies for posing what might be considered an uninteresting and superficial question in the title of this section. Whether you consider TIAS to be a focus for a 'scientific "meta-discipline" that integrates knowledge about a problem domain and makes it available for societal learning and decision making processes' (The Integrated Assesment Society (TIAS), 2005) or simply a loose gathering of researchers with a common interest in understanding how to make their work more applicable to messy problems, I would suggest that a shared understanding of our collective's ambition is a precondition of meaningful interaction.

There are certainly multiple senses to the meaning of 'Integrated Assessment' as we might employ the term here. Perhaps an initial (and certainly non-exhaustive) organization of these alternatives might highlight integration across; (i) disciplinary, professional or cultural perspectives, (ii) cause-effect chains, (iii) spatial and temporal scales, (iv) institutional remits and responsibilities, and (v) the description–diagnosis–prescription process. Research aspiring to IA could exhibit characteristics of one or several of these variants. The specifics of applied method and technique for each variant will vary; indeed a question of some import is whether a search for standard or perhaps benchmark methods and techniques for each variant would be a profitable exercise.

As suggested above, the principal incentive for the scientific community to engage in 'Integrated Assessment' is a wider social and political acceptance of holistic or systemic perspectives on socio-natural systems. Global media and business networks, religious and spiritual concepts which emphasise the connectedness of living things, and popular science versions of chaos theory have all contributed to this (indeed we will encounter this trend again in the final paragraphs of this paper). Politicians, increasingly powerless to address domestic concerns which are influenced by external stimuli for which they have no direct policy levers, seek deeper understandings of the relationships between processes and phenomena across time and space. Politicians have, of course, traditionally carried the burden of integration, particularly so during the 19^{th} and 20^{th} centuries as reductionism and specialism flourished in the sciences and arts. It is only relatively recently that commerce, industry, and governance bodies have challenged science to rebuild that which it disassembles so that action and intervention is informed by an understanding of consequences. The no-man's land between science and society, the responsibility for undertaking the transformation of knowledge into action, is an area of emotive dispute between knowledge producers and knowledge users. It is also a debate which the IA community should consider as being of central significance to its contribution.

So our perspective on the challenges which face our communities has changed; it has become broader, more catholic. But how are we to exploit this appreciation of connectedness for the benefit of our societies? Do we now believe that

a more 'integrated' understanding will enable us to better manage systems? In order for such a new viewpoint to be beneficially exploited, the entire chain of knowledge creation and use needs to be transformed. Formal problem definitions, research agendas, research methods, research findings, prescriptive recommendations, policy mechanisms, and policy implementation will all require revision. Mathematicians speak of a 'well posed problem' as being a condition for finding a solution. Only rarely do we stumble upon explanations and answers where we do not expect to encounter them. So, if we seek answers to questions about the nature of an integrated world, we would do well to reflect this theme in the succession of activities from Description, through Analysis and Diagnosis to Prescription.

There is nonetheless a further dimension to IA which demands consideration, reflection, and perhaps analysis. If IA can provide an enhanced understanding of the way the world works, what is the nature and status of this new knowledge? Are we seeking (or can we expect to find) general laws which are invariant across time and space, parochial examples which might help us set down general maxims, or culturally and thematically specific lessons which only provide limited insights for one case at one point in space and time? More generally, are the principles and rules by which we achieve 'Integration' to be consistent across disciplines, contexts, cultures, and applications. Clearly the problem does not end with the integration of scientific perspectives or contributions. Similar progress is needed to provide approaches to managing a dialogue between different claims to credibility and legitimacy across the sciences.

These issues are far from being merely academic reveries, of little or no significance to practical problem solving. For example, and to return briefly to the points articulated above regarding the science-society interface, the claims we make for our insights will necessarily influence the use to which they are put. More specifically, the basis of our understandings regarding inter-phenomena, inter-disciplinary, or inter-dimensional problems will be reflected in the appropriateness of different modes of intervention. Do the results of IA research suggest that we know more about the intricacies and complexities of the world around us and that we can therefore apply ever more detailed 'predict and prepare' or 'command and control' type policies. Or perhaps an IA approach exposes knowledge which suggests new models of sustainability based on an acceptance of variation, an awareness of the limitations of human understanding and intervention, and a recognition that yesterday is a poor guidebook to tomorrow.

So what characterises IA as an activity? How might we describe what we do to our colleagues and potential clients? There is, as yet, little evidence of a standard identity for IA practitioners in terms of a skill or knowledge set. There is however, a set of common aspirations which have to do with seeing IA as an 'opportunity to frame questions in a different way', or as 'a tool for selling science to policy makers' or 'a tool for decision making'. More ambitiously, there is a feeling that 'IA needs to strive to facilitate the structuring of knowledge' (EFEIA/TIAS, 2005). Although these objectives are largely concerned with the role of IA in planning and management, there is an additional

set of goals we might pose relating to the process of IA. For example: IA should provide supplementary insights that could not be accomplished with a series of smaller, more bounded, studies; IA principles should influence research team composition, method selection and research execution; and IA practice should have an appreciative and/or sympathetic audience. One might enquire whether we, as a community of practice, can deliver on these objectives? The following section prvides a (limited) context within which we might scope a response to this query.

2 Realising the benefits of integrated assessment: an example from the water sector

So as to provide a context upon which to base further discussion, this section reports a case study example of what would pass for a very characteristic or even standard Integrated Assessment. In many ways the following illustration is unexciting; it claims no particular innovation in method or technique and addresses a problem set which, in terms of its constituent elements, has been the subject of numerous research initiatives. Our experience with this project is however representative of many IA undertakings although it is as well to remember that it constitutes only one possible approach or flavour of integration.

The background to this example is UK government plans for the economic development of South East England which includes large scale commercial, housing and industrial development. These plans essentially shift major growth to the north and east of London, exploiting the Thames gateway and developing east to west infrastructure. Water resources are already under pressure in this region from the impacts of climate change and competing demands for water. Many areas of South East England are thought by the Environment Agency (Environment Agency, 2001) to have an unsustainable or unacceptable abstraction schedule in regards to both ground and surface water. One of the areas selected by the Government for intensive development is the M11 Corridor running from North East London to the city of Cambridge. Plans for the M11 corridor allow for between 250,000–500,000 new homes which could mean building density doubling in some areas from 25 to 50 homes per hectare. Areas designated for expansion include the towns of Harlow, Bishops Stortford, Dumnow and the city of Cambridge, with the potential for two new towns, near Cambridge and Stansted (Office of the Deputy Prime Minister (ODPM), 2003).

Possible response options for water service providers include; modifications to water resources exploitation regimes and/or building of new water reservoirs or extraction points, water distribution network expansion/rehabilitation, water transfer projects, demand management, etc. All these are likely to severely impact the long-term water availability of the area bearing the urban expansion.

It is not difficult to recognise the challenge here. Whilst the treatment and infrastructure networks which provide potable water and treat waste water are largely fixed in space, performance attributes and capacity, the communities

and built environments which they serve are constantly changing. Furthermore, process treatment and network capacity planning (in terms of both water and wastewater) for the water industry is influenced by a complex range of economic, physical, and environmental factors which serve as both constraints and opportunities. The sequence and pattern of (housing) development will clearly determine the optimum expansion strategy for networked water supply and sewage services. However, to turn the argument on its head, it is interesting to ask whether the overall efficiency of housing and water infrastructure expansion can be informed by the current configuration of pipes, pumps and treatment works.

Understanding the relationship between urban development and the proximity of existing infrastructure is not straightforward. With regards to the supply of water, the location of new urban development is often not dependent upon the existence of sufficient water supply but simply creates demand that the water companies must meet. So the existence of a sufficient water supply is not a required condition for development but is only a factor that makes development in a particular area more suitable. Our approach to exploring these issues has been to develop a spatially discretised strategic water demand and supply analysis tool (Figure 1). It consists of three sub-models, namely Land Use Change (LUC), Water Demand (WD) and Infrastructure (INF) linked sequentially in a chain to represent initially the traditional direction of influence between each sub-model. The LUC sub-model consists of a process to simulate changes in land-use (LU) distribution spatially across the region being modelled in response to regional development scenarios and water supply infrastructure location and capacity. The WD sub-model consists of a process to simulate domestic and non-domestic water demand based upon LU distribution and a set of demand parameters. The INF sub-model consists of two separate components: the Hydraulic Simulator (HS) and the Network Optimization (NO). The LU, WD and HS component are operated by a simulation engine. The NO is operated separately by an optimisation engine.

From a conceptual point of view, it is important to distinguish between the simulation and optimization components of the model. The former serves the purpose of analysing the effect that a given network expansion plan (set of network modifications that take place over the entire planning period) has on the land use and water demand spatial and temporal patterns change. The latter, seeks to identify the best network expansion plan according to some criteria that must be optimized. The whole model is driven by the scenario specified LU changes. Without a change in LU the model will do little. The LUC sub-model state is time-dependent (i.e., variable values need to be stored in memory between time-steps—the state at time t is a direct function of the state at time t-1). The WD sub-model simply determines current water demand based on the current LUC state. The demand state is not time-dependent and does not need to be stored between time-steps—it is calculated afresh every step. The INF sub-model state is time-dependent and so variable values need to be stored in memory between time-steps.

The planning horizon for the integrated model is set to 30 years, and the time

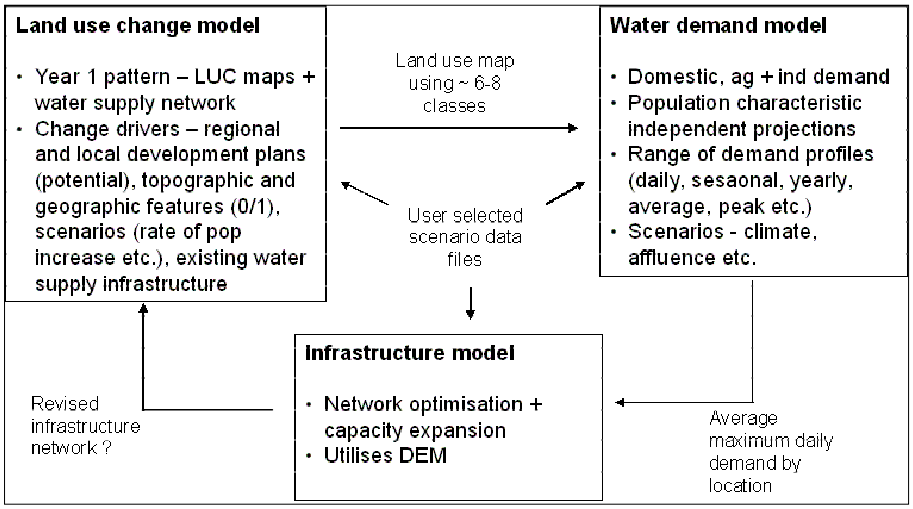

Figure 1: Overview of integrated model functionality and interactions

step of both LUC and WD models to one year. An evaluation of water supply network expansion options is conducted at five year intervals. Consequently, a network expansion plan consists of six sequential set of structural changes (topology and/or element characteristics, e.g., pipe diameter).

Space (the region being modelled) is represented by cells organised in a grid and nodes are organised in a network. The LUC and WD sub-models operate on the cellular grid representation of space whilst the INF sub-model operates on the node representation. There is however a need for the INF sub-model to relate cellular water demand to nodes and for the LUC sub-model to relate node pressure to cellular suitability for development. Consequently there is a formal representation of the spatial relationship between cells and nodes.

There are three main classes of question that can be addressed by running the model:

1. Exploring the impact of different network expansion options on network performance and/or the ability of development plans to be realised (i.e., houses to be built) under a particular land-use change scenario and set of water demand values with the aim of identifying an optimal network expansion plan.

2. Exploring the impact of different land-use change (regional development) scenarios on network performance and/or the ability of development plans to be realised (i.e., houses to be built) under a particular network expansion option and set of water demand values with the aim of identifying pathways for getting from the current land-use configuration to a planned future configuration.

3. Exploring the impact of changing water demand levels for different land-use types on network performance and/or the ability of development plans to be realised (i.e., houses to be built) under a particular land-use change scenario (regional development plan) and network expansion option with the aim of better understanding the impact of changes in water demand on water supply and regional development, and for identifying key demand management intervention options.

The model can be used in "simulation" or "optimization" mode. The latter simply requires running the former for as many alternative network expansion plans as need to be assessed. The optimisation mode is only relevant to the INF sub-model. Simulation mode allows the user to assess how different model properties & conditions (e.g., land use scenarios or WD parameters) will interact with network properties to influence the spatial and temporal patterns of land use and water demand throughout the planning period, given a specified network expansion plan.

We are, then, integrating primarily across classes of phenomena (e.g., land use, engineered infrastructure, housing), and across institutional remits (Water Service Providers, Local Authorities, Central Government). The work is cross-disciplinary and generates output which helps actors in the planning and development sector explore the interactions between their responsibilities ('the spaces between' as someone recently labelled them).

3 Discussion

To complete our brisk evaluation of the characteristics or benefits of IA, we should now revisit the points posed at the end of Section 2. There were seven specific points raised:

1. That IA is an opportunity to frame questions in a different way,
2. That IA is a tool for selling science to policy makers
3. That IA is a tool for decision making
4. That IA needs to strive to facilitate the structuring of knowledge
5. That IA should provide supplementary insights that could not be accomplished with a series of smaller, more bounded, studies
6. That IA principles should influence research team composition, method selection and research execution
7. That IA practice should have an appreciative and/or sympathetic audience.

In discussing these issues over the following paragraphs I have tried to be as objective as possible for someone who is intimately engaged in the research.

I apologise in advance to my colleagues in the project if my desire to be an impartial critic has led me to be either overly pedantic or unreasonable.

Our response to the first point listed above is unequivocally positive. By engaging commercial, regulatory, civil society, and governmental groups in a dialogue about the structure and design of our research process and method, we have, as a by product, promoted sceptical enquiry on the part of research users. The largely social process of consultation and co-design has legitimated a discussion concerning the robustness and credibility of existing relationships between planning and networked utility provision. It has brought together actors who would not normally encounter each-other. This type of value added occurs, in many ways, irrespective of the substantive contribution of the research activity. The research act functions as a catalyst for other forms of knowledge and value sharing; as a stimulant (or maybe just a convenient excuse?) for Social Learning.

As for Points 2 & 3 (the selling of science to policy makers and IA as a tool for decision making), the evidence from this study is ambiguous. Our experience would suggest that science as insight and learning does not need to be promoted to those who plan and manage intervention. The key issues here are perhaps the legitimacy, credibility, and integrity of particular scientific contributions rather than science per se. The premise that there is a 'gap between IA concepts and practitioners' (EFEIA/TIAS, 2005) is, I think, incontestable. However, whilst we can reasonably debate the problems of crossing the 'gap' (and indeed who should be stepping out into the void), there comes a point at which we should bear some responsibility for producing it. We must however ask ourselves whether IA is anything more than just a set of principles, concepts, insights, and frameworks. Can we list a set of tools and techniques which are unique to IA and might comprise the contents of an IA shop window?

To develop this theme further, some colleagues suggest that we should adopt a more pro-active role and 'not only hand over the knowledge but get involved in the process itself' (EFEIA/TIAS, 2005). Without wishing to sidestep the challenge, I would claim no direct experience of such strategies and pass responsibility for judgement on to others with more applicable backgrounds. However, I would point out that whilst a challenge to the traditional roles of stakeholders in the problem diagnosis, option selection and solution prescription process is long overdue, objectivity and independence are two reasons why scientific knowledge is valued. This consideration brings us back yet again to the question of what IA is; a philosophy, a movement, a perspective, a service provider, a meta-discipline?

As noted in the introductory paragraphs of this text, if IA is to provide an enhanced understanding of the way the world works, we should be able to describe the nature and status of this (new?) knowledge. Interestingly, in the case of the research project recounted above, Points 4 & 5 are strongly linked in that the structuring of knowledge through a co-examination of previously isolated phenomena and processes generates a significant advantage over a series of single dimension investigations. In simple terms, this advantage stems from the fact that an exploration of the dynamics between coupled systems (in this

case water supply networks and land use) can be conducted on equal terms. Single dimension studies tend to create a disparity in the perceived 'status' of phenomena; privileging those which are under direct scrutiny and placing the emphasis for response on those outside the system boundary. An IA approach enables not only the potential impact of A on B to be explored, but also the influence of changes in B on the nature of any impact from A to be examined. The exposure of such reciprocal or co-dynamic relationships is an intrinsic benefit of an IA approach. So, in the case described above, we are able to assess the influence of land use change (pace, pattern etc.) on efficient network expansion plans and the influence of existing network configurations on efficient land use changes.

The sixth point raised above merits some elaboration in the detail of the major influences on research team composition, method selection and research execution. These three elements of IA practice should ideally be at the heart of any prescriptive meta-method. I hope that we can agree on the need for IA flavoured research to be problem driven and, as such, selection of research team, method and process should be an explicit feature of research design rather than an implicit consequence of educational background and resource constraints. Unfortunately, I am sorry to report that, in this instance at least, the ideal has been tarnished by the limitations of time, money, and social networks. Research team composition was determined by acquaintance and availability, method selection by the path of least resistance through the consortium, and research process by the varying claims on individual time and the demands of post-graduate training programmes. This may appear an overly trivial explanation, but when I consider those occasions when the coordinating researcher(s) needed to make a decision, the decision space was invariably severely constrained by a non-intellectual consideration.

So, to conclude this brief assessment of the virtue of IA, we should respond to the final point which posited the need for an appreciative and/or sympathetic audience for our contribution. This is perhaps not easily answered by the research team themselves. In one sense, sympathy and appreciation is not enough. We certainly encounter interest, understanding and some enthusiasm amongst our research clients for an IA perspective. Such support is welcome as it authenticates the way in which the problem is framed, providing legitimacy for forms of enquiry which would otherwise appear irrelevant and/or unsubstantiated. I am however, sometimes left wondering whether an IA research activity can deliver benefit to research clients without engaging in the politics of intervention. Perhaps too often we retreat into the fortress of complexity by reporting that, having considered the problem from all perspectives, we can indeed confirm that it is a complicated and difficult issue which will require an integrated, inter-agency and interdisciplinary response. This is clearly not good enough. Our appreciation and understanding of the nature of the problem need not necessarily complicate analysis or paralyse prescription. Description and analysis do not always give sufficient grounds for robust advice but they should at least support identification or characterisation of critical system features or dynamics.

The preceding discussion is long on contingencies and short on reliable conclusions. Let me remedy this somewhat by drawing out two features of IA which I feel highlight the fundamental principals of the field. Firstly, there is an 'overall expectation is that IA will result in better decisions' (EFEIA/TIAS, 2005). It is difficult to envisage a set of circumstances under which this statement could be challenged. We would not be investing our time and intellectual capital in an endeavour which be believed would produce worse decisions. It remains for IA practitioners to specify and develop metrics which are both founded on an acceptable definition of 'better' and can be used to demonstrate the utility of IA. Secondly, I am intrigued by the possibility that 'IA could be understood as a craft for using [exploiting?] the best of each scientific field' (EFEIA/TIAS, 2005). As a scientific undertaking this agenda would appoint IA practitioners as coordinators/mediators of ontologies, epistemologies, methods, techniques, models, knowledge and collaboration. It would locate the contribution firmly within the 'science of science' tradition. The overt preference amongst the IA community for including wider constituencies in decision framing and forming would, however, add a unique dimension to the task. Perhaps a 'science of knowledges' rather than a 'science of science'.

4 Conclusions

In concluding this, all to brief, visit to the challenges of Integrated Assessment, we should perhaps locate ourselves with respect to broader social and intellectual initiatives and processes. I would select two such progressive programmes; knowledge creation, and holism.

The full social and economic implications of the Mode 2 revolution (Gibbons et al., 1994) are yet to be fully realised. IA as method is, in many ways, compatible with the Gibbons et. al. interpretation of how knowledge is usefully generated, distributed and utilised. The commoditisation of knowledge has advanced rapidly over recent years and the science project set in motion by Bacon, Galileo and Descartes is under threat from 'knowledge managers', 'knowledge engineers' and other soothsayers of the 'knowledge economy'. Such 'meta-knowledge' experts often fail to recognise or acknowledge the value of experiences which junior research practitioners have seen in the front line trenches of collaboration and integration. Consequently we have seen research funders over-emphasise the importance of networking and correspondingly under-emphasise domain specific knowledge. This problem is aggravated by the almost universal acceptance at Government and Supra- National level of a static conception of knowledge as 'know-how' (*sensu* Wikström and Normann, 1994) and 'know-why' that can be traded like postage stamps.

To quote yet another maxim, when wood is the subject of discussion, the opinion of a carpenter is to be valued. Disciplinarity (and by implication the excellence which accompanies it) is too often derided, even ridiculed. Trans-epistemic communication can be facilitated and exploited without abandoning conventional standards of rigour in the human, social or natural sciences. Hence,

interdisciplinary research is represented by mappings or bridges across disciplines (not necessarily onto either disciplinary space but perhaps into a new intellectual space) rather than erosion at the edge of disciplines. Such a model of interdisciplinary endeavour, though discussed in the literature (e.g., Salter and Hearn, 1996), has largely been ignored.

My own view is that knowledge innovation is best served by the conservation of intellectual diversity, specialist study and strategically focussed connections between knowledge communities to service some common interest or project; a balance between depth and breadth, not revolutionary extremism. One might suggest that whilst it is easy to theorise about knowledge and discourse, it is much harder to forge legitimate, fruitful, and dependable connections between theory and method, between the natural and social sciences, between science and society. In one sense, the IA community needs less unproductive introspection (i.e., this paper!) and more reported examples of collaborative working producing demonstrable value.

And what of the association between IA and holism? There are a number of intellectual and ideological paradigms which promote evaluation and intervention based on ideas of holism. Academia has responded to these ideas by addressing issues of complexity and integration. However, holism as an interpretive and prescriptive framework contains two very different messages. The first suggests that understanding the connectedness of the world around us is a prerequisite for effective action. The second implies that a (usually more naturalistic) commonality of ideals, goals, interests, and problem solving approaches will somehow promote harmony and efficiency. To illustrate this point in more detail, appeals in support of the latter of these messages are often founded on a plea for us to recognise the shared nature of the human condition. Without wishing to disparage this noble and often effective appeal, it is equally true that the features of our person and environment which impart identity are heterogeneous. The peculiarities of landscape, climate, language, family, experience, belief, skill, and knowledge make us what we are.

The desire to reconcile this tension between the many and the one, diversity and unity, orthodoxy and dissent, constitutes a ubiquitous theme of human endeavour. The challenge has been articulated and explored in many different ways throughout human history. What the discordant harmony of circumstances would and could effect ('Quid velit et possit rerum concordia discors') was a subject addressed by Horace in first century BC Rome and the motif of harmony through discord was explored musically by J.S. Bach in his 'Canon concordia discors' (BWV1086). More recently, the political philosopher John Rawls stated the challenge thus 'How is it possible that deeply opposed though reasonably comprehensive doctrines may live together and all affirm the political conception of a constitutional regime.' (Rawls, 1971). In the first part of the 21st Century concerns over a 'Clash of Civilizations' has provided a further incentive to consider how diversity can be reconciled with social stability whilst preserving the 'Dignity of Difference' (Sacks, 2002). IA would be a superfluous endeavour in a flat land of sand with one climatic season and populated by replicants supporting a single product economy. It is the variety and com-

plexity in our case study problems which make them candidates for IA. In this context, the challenge facing the IA community is truly momentous; to identify the knowledge required for policies which support sustainable livelihoods, justice and development for all within a world of heterogeneity and limited natural resources.

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