

# When The Modeller Meets The Social Scientist Or Vice-Versa

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## EXTENDED ABSTRACT

“Which comes first .... the model or the process?” This question almost pales the chicken and egg question to insignificance. Almost in desperation, modellers are acknowledging that there may be a social component to their work if their models are to be taken from shelf storage and actually be of value to real decision making processes. While participatory modelling has become fashionable among many modellers, others request social scientists to “add some social stuff” to their models. On the other side of the coin, as a social scientist, I believe modelling could provide me with a valuable tool to assist in community decision making and trade-offs, particularly in achieving procedural justice amid a wide range of points of view.

But the meeting of the two worlds seems to be as complex as some of the systems currently being addressed, and to date it’s been like ships passing in the night. This paper explores a range of issues, differences and challenges that need to be resolved if the potential value of social science to modellers, and models to social scientists might be realised. It is principally based on personal experiences, both good and bad.

The paper explores the nature of social data and common misconceptions. It identifies three important assumptions that are made in defence of modelling that I believe are at the root of relationships between social scientists and modellers. These are: we know the problem and we need a model; more information leads to better management decisions and outcomes; and we need to integrate social science into models.

It further explores some practicalities of working together from the way the research question is approached, through the recognition of the incorporation of personal values to problem definition and solving, to the meaning of adoption.

The paper questions the purpose for building a model and the reality of trying to incorporate the complexities of social behaviour. I suggest that frequently the client commissions a model to avoid having to engage with the community. I pose the question, “Is the proper place for social science in the model or should the model be serving the social process?”. Implications associated with trust in the model and the model maker, particularly in relation to the model’s assumptions, are also touched on. While acknowledging the need to push the scientific boundaries, the problems of validation and uncertainty in agent based modelling are discussed, as well as the meaning of what is being attempted.

While many of these issues do not sit comfortably with social scientists, it’s a discomfort they need to set aside and to contribute their specialist expertise in trying to find answers. In reply, however, modellers too could experience some discomfort and contribute to assisting community decision making processes in the interests of mutual collaboration. Too often, local knowledge of communities is discounted as well as their ability to come to meaningful decisions with the assistance of a model that is “accurate enough” and can be run and questioned multiple times during the course of an afternoon workshop.

So while the modeller increasingly requires the cooperation of the social scientist to assist in the resolution of challenges in the development of their models, I need a modeller to assist me in pushing the boundaries of social science. This demands understanding and cooperation on both sides and the recognition of the relative disciplinary skills each brings to the respective challenges. This approach also suggests the need to work in the real world with our partners, the community.

## 1. INTRODUCTION

This is my story. I have spent the last couple of years interacting with modellers on a variety of topics and challenges. I have to admit that modelling fascinates me, not perhaps as it does a modeller, but as someone interested in social systems, problem solving and participatory decision making. The differences in the ways that social scientists and modellers naturally think about the same subjects are also a source of fascination to me. For example, I was interested to see people constantly being referred to as “agents”, which I thought nicely sanitised the topic, but I was utterly amazed on another occasion to see them being referred to as “decision making entities”. Here might be the beginning of an inkling of understanding of why there seems to be a gulf between so many modellers and social scientists. But this aside, I feel that modelling has a lot to offer social science if we could only agree on and develop a common purpose. And these days it seems that anyone who doesn’t have a model isn’t really in the game. Hence my fascination, and my endeavours to work with modellers.

It appears too that the fascination for the opposite also occurs on the modellers side. I have been approached on many occasions over the past few years to provide a variety of social science inputs from the human (agent) behavioural aspects in Agent Based Models, through to adding some “social stuff” to a decision support system. Some of these requests are more attributable to being able to tick the “social box” and get funding support than being genuinely interested in the subject. But for others, it is the realisation that “agents” can behave in unpredictable ways, or that “entities” can often make decisions that are difficult to explain.

I have to admit that some social scientists when faced with these challenges can be a little “precious”, dismissing any attempts to try to represent such complexity as human behaviour or decision making in a computer model. And while I will say that I’m still sceptical about the possibility of doing this, I do like a challenge and so I have been throwing myself into these interactions with some enthusiasm, but also with total ignorance about the mysteries of modelling. I have been relying on goodwill, good communication and the mutual recognition of the other’s disciplinary expertise.

So this is a bit of a ramble that explores the issues that have arisen in my journey. I don’t have a lot of answers, but I do highlight issues that we need

to resolve if the partnership is to be mutually beneficial.

## 2. WHAT IS SOCIAL DATA?

One of the first issues that I came across was just what were we speaking about when referring to social data. For many, social data was not as I thought of it, but little more than demographic and basic economic data, such as population, employment; income; family structure and so on. While this probably is, in the strictest sense, social data, you do not need a social scientist to provide it. A call to the Australian Bureau of Statistics will get it for you.

The next issue is that even though we may both be talking about attitudinal data, or social values, beliefs or behaviours, the applicability of this data from one community to another is not guaranteed. Nor is how they use these values, attitudes and beliefs to make behavioural decisions easily transportable. So the request to “*just use your experience about how farmers make decisions to tell me how they’ll behave on the other side of the black stump*” is not really an option.

Social data can be highly quantitative or it can be highly qualitative. Frequently it is a conversation. While the latter is more difficult to document and store, there is no reason why qualitative models of ways of thinking can’t be used, just as quantitative decision making models can be. An open mind to the value of qualitative data can add value to a model.

A major issue is the long term validity and relevance of the social data. Prediction and simulation frequently work in long-term futures. In comparison, attitudes and behaviours change over relatively short time frames (though not quickly enough for many policy makers and natural resource managers). So an attitudinal or behavioural model that might be developed for a specific predictive model or simulation, will have limited validity five to seven years into the future.

So the first conversation that the social scientist and the modeller needs to have is:

- what social data is required by the modeller, in what form, and how will it be used?
- how can this be collected and how long will it take?
- how long will it be valid?

Some of the answers to these questions might threaten the viability of the proposed model or its

design, and it shows the necessity to begin this conversation early in the concept development.

### 3. MAKING ASSUMPTIONS

Assumptions do not sit easily with social scientists, except perhaps with economists. But my story is more about main stream social science than about economics, which has related approaches, but its own traditions of measurement and analysis. There are two kinds of assumptions, those that are made in the design and building of the models, and those that are made in the defence of modelling. The first I will address later in this paper, confining this section to a discussion of the second. While I am not painting all modellers with the same brush, I am suggesting that most will have assumed at least one of the following at some stage of their careers. And for some, all three are highly relevant.

The first assumption that I'd challenge is: *we know the problem, and we need a model*. It seems very rare these days that research programs are not all about making models. Grant proposals are full of describing the problems and proposing the models to address them. Too infrequently is the identification of the problem challenged. Why is the researcher's definition of the problem the right one? How often do we stop to consider that the perception of the problem is different depending on the disciplinary perspective we come from? How often do we stop and think that the problem may be a combination of perspectives? How often does the modeller seek, or use, local knowledge when defining and addressing the problem?

If we start from one definition of the problem and build the model to solve it, the model may sit on the shelf, failing to be adopted -- yet again. But when this happens, it is mostly the end-user that is seen to be at fault. Is it ever questioned, "were we addressing the right problem?"

Let me provide an example. A modeller set out to develop a model that addressed water quality problems in a catchment. There was an immediate assumption that the cause of the problem was diffuse source pollution, and further assumed that it was caused by farming practices and erosion. It soon became evident, though, that most people in the catchment did not believe that this was the cause, and believed it to be associated with Council practices. In any case, most people thought they had a bigger problem with weeds than with water quality.

In this case, had this model been developed from the first definition of the problem, it was unlikely

that it would have been adopted. It would have addressed a cause of pollution that was not locally supported, and modelled a problem that was not seen as a priority.

This example doesn't necessarily mean that the first assumption of the cause of the water pollution was wrong, but it does indicate that the cause most likely would have been a combination of the viewpoints (Jakeman, Letcher and Cuddy, 2003). There would also need to be local agreement that the model was addressing the correct problem before it would be accepted. There would need to be agreement locally that a model was what was needed to address the problem. Is a thorough understanding, quantification and prediction of the problem essential in finding a solution?

This brings me to the second assumption that I'd like to challenge which is, *more information leads to better management decisions and outcomes*. Hence, we need a model to organise and interpret the information. This assumes that we know what information is needed, and what facts will govern the decisions that need to be made. We constantly hear about the need for "informed decisions" and the need for people to thoroughly understand the situation and hence make the "right" decision.

But who decides what is the right decision? Who decides what information is needed? Local communities are able to make decisions without a full depth of understanding of the issues. In fact, sometimes too much information can be detrimental to decision making. People can assimilate only so much information before it becomes too much and they get lost in the detail.

This is what is happening currently in the discussion of potential climate change with communities. It is very difficult to try to explain the uncertainties of climate change and the potential implications of what might happen. Yet climate scientists are insisting that they need to get their climate models absolutely right before they take this information to the community to discuss impacts and adaptation. We could, though, provide a range of broad scenarios and start to discuss what things in life could be adapted to accommodate.

People are able to clearly enunciate their information requirements, and this is usually far less than the experts believe they need. "Is it a little bit of water or a big bit of water?" -- that's frequently all people want to know.

The third assumption I'd like to address is that *we need to integrate social science into models*.

Why? What are the benefits? We need to incorporate social science in the development, design and implementation of models, but do we need to put it *in* the model? Is the model a tool for people, or is the model an end in itself? I suggest that many modellers consider the latter to be the case, and it is likely that this provides a feeling of power and elitism in the role of the *expert*. I have observed the “dark age” professional behaviour (Thomsett, 2002, p. 5) of the power of *experts* over the *users* in some parts of the modelling community, while others have also moved to the “partnership” approach where the *experts* and *clients* interact with close to equal power.

The latter relationship would suggest that the role of social science in modelling would more be in the facilitation of process, where a model is jointly designed and built to solve a socially defined problem. That is, a model is developed as a tool to serve a particular community. This then introduces the question of “who is the client?”. Is the client the person or agency that commissions and funds the model development, or is the client the people who are a part of the system being modelled?

I propose that these assumptions are at the root of relationships between social scientists and modellers, and influence interactions from the moment we start to work together.

#### 4. WORKING TOGETHER

I had a fascinating experience earlier this year. I sat in a group of modellers and social scientists on a day when we’d decided we needed to go about building a model to better understand each other, and how we might integrate the two disciplines. We had identified a case study of a prominent local catchment, highly valued and used by the local communities, but with increasingly serious environmental problems. We decided we wanted to build a model to help sustainably manage the catchment. So we all sat around a table to begin this.

A modeller immediately launched into a list of “things” she needed for the model – data requirements, and modules, and other “things” that modellers would be familiar with. I listened for a while and then I said, “Who are we doing this for? What are the issues we need to address? Who needs to be involved? Who decides what should happen in the catchment?” There was genuine confusion and questioning on both sides.

So this was the first enlightenment. I wanted to start with a list of people to talk to. She wanted to

start with the physical data and model specifications. The approaches were similar in that they both involved data collection, but for quite different purposes. One had assumed the problem, the other wanted to identify and define the problem.

We quickly realised it was important to get the team right if we were to live through the experience. It was important to have personalities that could work together, talk through their different approaches, and respect each other’s disciplinary knowledge and expertise.

Another aspect that I have experienced working in multi-disciplinary teams, is the frequent inability of many scientists (of all disciplines) to recognise that they bring their own values to the problem definition and solving (Nowotny, Scott and Gibbons, 2001). I’m referring here to personal values as opposed to professional knowledge, though the choice of profession often eventuates as a result of personal values. These values can often be threatened if there is a suggestion of involving communities in the problem definition and solving. The pure bio-physical solution may not be acceptable to the impacted communities, but to consider otherwise is often very difficult for the scientist. But what makes the scientist’s values any better than those of the community’s, especially when it is not the scientist’s life and livelihood that the solutions are affecting?

It is important therefore, when forming workable and functioning multi-disciplinary teams, to recognise what values we all bring to the project and how these might affect the ways we work together.

Another issue that I have found of possible conflict when bringing the two worlds together on a project is the keeping to project deadlines and milestones. For a social scientist working with a community, the promise to come back at a certain time with a particular product, even if it’s only the results of early thinking, the deadline must be strictly met to retain credibility with and the co-operation of the community. For a biophysical scientist, the milestone/deadline date seems to mean “about that time – give or take a week or month or so”. This was another cause of initial frustration that I experienced, until I realised that it was a further example of the “different languages” we both spoke.

The final lesson I’d like to draw attention to when trying to work together is the issue of “adoption”. By the very term, it seems to imply that something is handed over to someone which they should then

use. How often is a social scientist asked to help get a model or practice adopted by a community? Perhaps if the term was replaced by one such as “partnered development”, there might be a greater understanding of what needs to occur for successful adoption.

## 5. THE MODEL

After all this, and we’re talking the same language, let’s start work on the model. The first question I’d ask is “why are we building a model?” and often, I believe, the purpose for at least one of the stakeholders (eg. the client) is to avoid interacting with people. If we build a decision support system, and put the social values in it, then we never have to go about that time-consuming process of community engagement in making the decisions. This may be a legitimate proposition where the ability to work in “real world” situations is limited (Srblijinović and Škunca, 2003). However, generally speaking, the decisions are unlikely to be accepted by communities in situations where they could have been directly and easily consulted, and especially if they have not been involved in the model development.

It is in this case that I ask if the proper place for social science is in the model, or should the model be serving the social process. That is, should we provide for the incorporation of social values in decision-making through community interaction *with* the model, or should we be trying to put the values data *in* the model, which then provides a decision? Unfortunately, acceptance of the model’s decisions or outcomes by the community is only as good as the acceptance of, and trust in the model itself. This applies whether the purpose of the model is prediction or simulation.

A model will be as trusted as is the model maker, and this will apply to both communities in general and also to clients and stakeholders. “Trust me I’m a scientist” doesn’t go down well anywhere these days. People will sooner trust the information given by their highly visible, and well known plumber than they will a “faceless” scientist. A major problem, though, is that it takes time to be trusted, and even if you interact with your community, the three year funding cycle is frequently against you. People will just start to get to know you and trust you when the three years are up and you’re about to leave.

An important part of trusting the model is also knowing and having confidence in the assumptions. Communities know that models are based on assumptions, and they are generally as comfortable with these as are social scientists. The

first thing they will want to know about a new model is, what are the assumptions. These need to be clearly documented so that users in years to come, when you are no longer associated with your model, are able to access them and consider the validity of the outcomes. However, the development of assumptions in isolation of the users/social group in consideration, where they have not had input, is likely to lead to a model that is not adopted, or outcomes that are not accepted.

Agent Based Modelling is providing a whole range of new challenges for the incorporation of social and behavioural data in modelling and its interaction with the biophysical components. While I find these challenges exciting, and I enjoy trying to find ways to do this in some meaningful way, I remain sceptical that what is hoped for will ever be achieved. In this regard, I am concerned that many modellers may have unrealistic expectations of what they can do, and how meaningful will be the output.

The number of interacting agents and all the social factors that need to be taken into account in different simulation conditions are, generally speaking, too large to incorporate comprehensively in an environmental model (Parker et al., 2003). For example, while it may be possible to quantify and represent the range of factors involved in the decision making processes that are behind a certain environmental management behaviour of a farmer (eg. the uptake of new irrigation technologies), this behaviour is not the only one coming into play in the overall management of his farm. And this is but one farmer. Further, the number of factors that are likely to impact on the decision making processes of the many farmers at any given time will be many and varied. Then, as stated previously, this behavioural decision making process is unlikely to be valid for the time period expected for the model’s simulations.

Validation, therefore, is obviously a major problem and does not engender confidence by lay people in these models. Validation of agent-based models is largely unexplored (Veldkamp and Verburg, 2004), and the impact of real world turbulence on causal mechanisms in complex systems makes validation a highly speculative process (Srblijinović and Škunca, 2003).

How often does the modeller put him or herself in the shoes of the “agent” that is in the process of being represented in the model? How confident would you be that you could validly represent in your model your values and decision making processes that you experience in the range of your day to day decisions?

Some modellers choose to ignore this difficulty for a variety of reasons, not least of these is that they become absorbed in their artificial societies of interacting agents, rather than by real societies of real people. It is this that frequently produces antagonistic communities who reject the artificial world of the modeller and this in turn produces a generalised lack of acceptance of all future models. It is also in these circumstances that the social scientist will point out all these apparently intractable difficulties and question the meaningful nature of the project.

While the inherent difficulties associated with the uncertainty in these models are acknowledged by many modellers, this rarely results in questioning the usefulness of the models to the clients or communities. Nor, apparently, is the possible self-indulgence of using scarce research resources in these exercises questioned. The supremacy of the model development seems to over-ride other practical considerations.

Many modellers discuss the necessity to better communicate the issues associated with uncertainty in the model outcomes to their clients, but I believe that this is where the clients and the modellers are at cross purposes. Models are generally commissioned by clients and communities because of their belief that the models will *reduce* the uncertainty they experience in assimilating and organising information about complex problems, and will assist them in making decisions. It is therefore of no use to them to hear that the model construction involves as much uncertainty as they feel themselves.

It is unfortunate, though, that the social scientist's questioning of these issues is frequently seen as obstructive behaviour and a lack of willingness to participate in the challenge.

While I am willing to "play" in these circumstances, I cannot help but return to my original question – "should the community serve the model, or should the model serve the community?" I can see so many circumstances where a model could assist the public decision making process and probably end up with better decisions. But to do this, I need a modeller who will produce a model that is useful to me.

I need a model that can be run frequently in a community workshop over the course of a day. I need a model that will incorporate the rules of social justice (Nancarrow and Syme, 2004) that the prior research will have produced, which will help participants make trade-offs, while seeing the environmental outcomes of their decisions.

I need a model that will run in a short period of time and be "accurate enough" for community decision making – where a community only needs to know if "it's a big bit of water or small bit of water". I need a modeller who is as prepared to engage in my questions as I am with his.

## 6. CHALLENGES

The challenges I have raised fall into two broad groups: the role of social science in model making, and the role of models in social science. These two groups have many common issues. I believe that modelling and social science could do great things together and be of significant use to society and environmental management. But the two worlds need to better appreciate each other.

I understand that science must push the boundaries and challenge the impossible, and this is what attempts to represent human complex systems in environmental simulations are doing. And despite my doubts, I am embracing this concept and working with people I really admire and enjoy the interactions – each recognising the other's disciplinary expertise.

On the other hand, some of my past experiences have been less than enjoyable. There are some modellers who believe, by reading a book or two, or by developing a one-size fits all social data gathering process, they can provide the necessary social science input to the model. Their models must, in these cases, surely be sub-optimal from what they could be. There is a vast public involvement and human behaviour literature which can be accessed through the interaction of a social scientist on the model building team. As I have to said to some, "tell me what you need to know, and in what form it needs to be, and I will get it for you."

Working with a social scientist, though, can be uncomfortable for a modeller. The purpose of the model will be questioned. The participatory development will be promoted, and the assumptions and meaning of the outcomes will be challenged. But if you can work through these areas which are outside your comfort zone, the model will be more likely to be adopted.

But what of what the modeller can do for the social scientist? I understand that many bio-physical scientists consider social science to be soft. Social science is seen to be of service only to the hard sciences, and then only when they run into people problems. The notion that modelling could be of service to social science is not generally

considered by the modeller, even when challenged to provide assistance.

And where does the community fit in all this? They are studied by the range of experts, and then told what they should do. But when they are the third person in these studies, they generally don't do as they are told. The community recognises the value of what the experts know, but is constantly frustrated that the experts do not recognise the value of what they know.

Perhaps the answer lies in a combination of all these challenges. Perhaps we should be pushing the boundaries of science and challenging the impossible as a team, each recognising and contributing our relative skills. But instead of working in an artificial environment, work in the real world with our partners, the community.

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