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Uncertainty Metaphors, Motives and Morals

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INTRODUCTION

If we are to understand how and why people construct and respond to uncertainty as they do, then we need accounts of underpinning motivations and moral orientations. As presented in Chapter 2, metaphors provide insights into these, so we begin by briefly revisiting metaphors about uncertainty, examining those used in the chapters in this volume. We then explore motivational aspects, before moving on to the relatively uncharted territory of morals. While it may seem odd initially to consider the notion of 'good' and 'bad' uncertainty, it turns out that many disciplines and, especially professions, harbour views of exactly this kind.

METAPHORS

As Smithson highlighted in Chapter 2, most of the metaphors that are used to describe uncertainty are negative. While a number of these metaphors appear in the chapters of this book, it is interesting that there also appear a number of new and mainly positive ones.

Among the metaphors reiterated in the discipline-, practice- and problem-based chapters are:

- obstructed vision ('blur the truth', Chapter 6);
- sexual intercourse ('lust for certainty', Chapter 5); and
- insecurity and fear (wariness, Chapter 7; fear, Chapter 22).
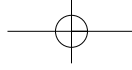
New negative metaphors include:

- looking shifty (Chapter 11);
- crippling (Chapter 19); and
- certainty as the Holy Grail (Chapter 16).

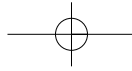Positive metaphors about uncertainty include:

- uncertainty as growth, with the law only being certain when it ceases to grow (Chapter 23);
- uncertainty as health and fundamentalism as pathology (Chapter 5);
- uncertainty as food, as in being the 'bread and butter' of statistics (Chapter 7, which turns the usual negative food metaphor about uncertainty on its head);
- uncertainty as stock-in-trade for historians (Chapter 11); and
- uncertainty as a source of inspiration, artistic freedom and creativity (Chapters 9 and 10).

Given that the authors of these chapters are a self-selected sample, it is not too surprising that they often thought about uncertainty in positive ways. These examples show that metaphors about uncertainty are both pervasive and power-ful, and raise a question about suitable metaphors for a more integrated view of uncertainty. Such metaphors would emphasize not only its dual positive and negative nature, but also its complexity. Metaphors are crucial here because the very intangibility and the inherent difficulties in thinking or communicating directly about the unknown compel us to fall back on metaphorical repertoires to a greater extent than when dealing with most other concepts.

MOTIVES

There are numerous examples in earlier chapters and elsewhere of motivations for reducing uncertainty, which is the dominant response in many discipline and practice domains. Even the motivation for researchers, creative artists and explorers to seek the unknown typically is followed by a motivation to overcome that unknown as soon as it is discovered.

Nevertheless, seeking the unknown as a spur to creativity is also a strong motivation. For example, Grishin (Chapter 10) describes the 'complementari-ness between the certainty of technique and the creative principle of uncertainty as a source of inspiration', presenting a number of examples of ways in which artists challenge themselves with uncertainty. Similarly, Pickard (Chapter 5) emphasizes the importance of uncertainty in stimulating creativity in theological thinking, generating diversity and richness in modes of expression of faith. Such creativity is associated with excitement. For example, Mackey (Chapter 9), in

describing jazz improvisation, writes of how 'spontaneity and uncertainty create a sense of excitement in both the player and the listener'.

However, uncertainty can also be a demotivating force. As Smithson (Chapter 18) points out, in psychology the tradition of the 'certainty maximizer' concerns 'the debilitating consequences of uncertainty, unpredictability and uncontrollability for the affective, cognitive and physiological capabilities of the affected organism'. Smithson also explores emotion-based theories of anxiety as a consequence of uncertainty. McFadden and colleagues (Chapter 22) take a similar line, demonstrating how terrorists have learnt to capitalize on the dysfunctional aspects of uncertainty, using it as an effective weapon for destabilization. Moore (Chapter 15) provides yet another perspective from inside politics, where delay is used to engender uncertainty and hence to block the introduction of new policies and programmes:

> *Those who undertake a change in the 'order of things' need to understand that the practice of policy implementation has inherent hurdles, the greatest of them being the use of delay. With delay comes uncertainty. Thus for those who wish to oppose a policy process, delay can be an effective tool for creating uncertainty. Those who are trying to achieve a goal will be forearmed if they understand delay and the consequential associated uncertainty.*

Finally, there are important disputes over whether uncertainties can be reduced or even specified. In Chapter 13, Perez's portrayal of complex systems thinking highlights a division between 'grounded reality and artificial metaphors; social sciences and computer engineering; constructivism and positivism', with the constructivists claiming that the non-linear dynamics and self-organizing properties of complex systems invoke irreducible uncertainties and the positivists claiming that such systems nevertheless are at base deterministic and mathematically describable. The constructivist approach emphasizes creative open-ended engagement with uncertainty; the positivist approach champions specification and ultimately uncertainty reduction and even systemic control.

In Chapter 23, Jones describes another kind of debate, namely the long-running dispute in law between those who would specify numerical probabilities for standards of proof (for example 'beyond reasonable doubt' or 'balance of probabilities') and those claiming that such specifications are misconceived. The nub of the dispute concerns two stances regarding the veridicality of the court's decision in an individual case. For the camp rejecting probabilistic assignments, 'the dispute is not about "on balance" or "achieving justice in the long run", but about vindication in the particular case'. The other camp is more concerned with procedural fairness and being more often right than wrong in the long run (as in Blackstone's famous adage that it is better for ten guilty criminals to go free than for one innocent person to be convicted).

There are, however, a number of other important issues regarding motivation at the individual, interpersonal and intergroup levels which have received relatively little attention, apart from in Smithson's chapter on psychology (Chapter 18). These are now dealt with briefly.

The individual level

There are three key aspects to the ways individuals think about and deal with uncertainty. First, human beings require ways of making sense out of unexpected events and outcomes. They also are strongly motivated to think counterfactually about undesired outcomes. Finally, they need to prognosticate and decide about the future. Furthermore, human engagement with ignorance or uncertainty is generally a mixed-motive enterprise, as we have pointed out above. People are not always motivated to eliminate or deny uncertainty. Instead, uncertainty can be actively sought, created, utilized, and traded against other benefits or costs.

To further highlight the point that human beings are not invariably motivated to eliminate uncertainty, particularly by an endless quest for new information about the world around them, it is useful to demonstrate how motivations to reduce uncertainty are complicated in at least two ways. First, there are powerful motives that countervail against the indiscriminate acquisition of new information, effectively rendering information searches highly selective and constrained. Second, some motives even oppose acquiring apparently relevant and useful information, thereby imposing constraints on the uncertainties individuals elect to reduce versus those we prefer to maintain.

Two strands of empirical and theoretical work in cognitive psychology invoke the idea of generalized and pervasive tendencies to avoid or ignore information. One is the 'bounded rationality' view of how people make decisions under uncertainty. The other is the literature on 'confirmation bias'. Both are important because, although they treat uncertainty as unproblematic, they highlight universal tendencies that militate against the notion that people indiscriminately seek information.

The bounded rationality approach is reviewed in Smithson's chapter on uncertainty in psychology (Chapter 18). Human beings and other animals make judgements and decisions not only under uncertainty but also under limitations in cognitive (thinking) capacity and time. Longford (Chapter 19) captures this latter issue in his observation that 'information overload creates a state of confusion, frustration and, in many cases, desperation'. As Smithson points out, psychologists have linked particular orientations towards uncertainty with concepts such as the 'well-adjusted' or 'intelligent' person. Nevertheless, such notions as a connection between intelligence and a tendency to think rationally are counterbalanced these days by findings such as experts' ability to make more rapid and more effective decisions with fewer cues than novices.

Confirmation bias, on the other hand, refers to information processing wherein 'one selectively gathers, or gives undue weight to, evidence that supports
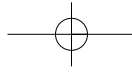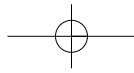
one's position while neglecting to gather, or discounting, evidence that would tell against it' (Nickerson, 1998, p175). More specifically, there is widespread evidence that this bias can operate unconsciously. Most explanations for confirmation bias point to how it reduces cognitive load, in other words how it relieves pressure to think and decide. A crucial mistake in many perspectives that privilege knowledge over ignorance is the failure to realize that knowledge seeking and possession are not costless. They require time and energy. Furthermore, there can be social costs in seeking information. Directly interrogating someone, for example, is socially inappropriate or 'costly' in many circumstances.

The power of confirmation bias is acknowledged in some domains of professional practice which seek to reduce or eliminate it. As Delaney (Chapter 12) shows, an important task of futurists is to combat confirmation bias. Longford's account (Chapter 19) of training for intelligence operatives likewise includes the goal of revealing blind spots and eliminating confirmation bias (along with several other cognitive biases). This emphasis is echoed in prescriptions such as the 'robust adaptive planning' framework of Lempert and his colleagues (2002). Their aim is to develop scenario-building and decisional techniques from the standpoint 'that most traditional decision tools exacerbate the innate human tendency to overestimate the certainty with which we can predict key trends and discontinuities affecting the success of our decisions' (p420).

Turning now to motivations to not reduce uncertainty, in Chapter 2 it was argued that people have coherent reasons to remain ignorant about available information directly relevant to themselves. The examples invoked motives ranging from denial to entertainment value. A much broader class of such examples, however, involves weighing up potential consequences of risks against the informational benefits of risk-taking. As Dovers and colleagues (Chapter 21) point out, the precautionary principle explicitly stipulates that it is not worth risking environmental degradation in attaining scientific certainty. In other words, the opportunity for acquiring relevant information about the impact of a risky influence on the environment should be foregone in order for potential degradation to be avoided.

Another area in which similar trade-offs are considered is vulnerable populations. Debates over child safety frequently revolve around weighing hazards against developmental benefits. Thus a popular claim holds that a no-trial-no-error approach to child-rearing impairs learning. A typical example is an opinion piece in *The Guardian* (Anthony, 2001) decrying the deeply safe, modern 'adventure playground' for its absence of any opportunity for children to learn about their physical limits and how to handle ordinary physical risks. A less typical, but in some ways more telling, observation is Oliver Sacks's (2001) reminiscence that a contemporary child's chemistry set cannot teach nearly as much about the nature of reagents as the one he could obtain as a child more than a generation earlier, which contained more chemicals and allowed more dangerous experiments to be performed.
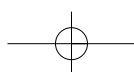
Moore's remarks (Chapter 15) on ethical behaviour for politicians provide another example of a widespread motivation for not reducing uncertainty. In political climates where being seen to do good is less risky than actual account-ability, and the media pursuit of political accountability is biased and/or incompetent, politicians may find it safer to follow the more electorally secure path of uncertain progress rather than clear, measurable goals and targets. Measurable outcomes of achievement render the government much more vulnerable to opposition, community and media criticism.

There are many other trade-offs and even dilemmas (as pointed out in Chapter 2) regarding motives for dealing with uncertainty. Among the most obvious is reducing uncertainty in one area at the expense of another. Although the emphasis is not on the individual level, this is the main thesis of Furler's chapter (Chapter 16) on the management of uncertainty in the health domain of the Australian Public Service. Here the pursuit of political certainty has proceeded at the expense of uncertainties about healthcare provision and resources. Nor has that expense been limited to attrition through neglect. Furler points out specific ways in which political agendas have actively opposed and reduced the capacity for expert input and health-related research.

In addition to trading off uncertainty about something for uncertainty about something else, people also have motives for trading kinds for amounts of uncertainty and trading one kind of uncertainty for another. Smithson's chapter on the psychology of uncertainty (Chapter 18) described how Ellsberg (1961) demonstrated that people prefer precise to ambiguous probabilities, and Smithson (1999) showed how people prefer ambiguous agreeing information to conflicting precise information. There are now several examples of how people can be induced to trade one kind of uncertainty for the other kind. Eisenberg (1984) claimed ambiguity is used strategically in organizational communications for several purposes. One is to achieve 'unified diversity', whereby a diversity of interpretations of such things as mission statements or organizational goals are permitted to exist and dysfunctional conflicts are avoided. In short, to build a working consensus it is counter–productive to be too precise about the matters under negotiation, which is a clear instance of conflictive uncertainty (disagree-ments) being traded off for vagueness.

The interpersonal and intergroup levels

Let us now move to a more social level and explore the motives behind negoti-ated arrangements involving uncertainty and ignorance. A dominant assumption in communications and organizations frameworks is that coordi-nated action requires full communication among the actors involved. In short, everyone must be certain about what the others think the purposes, goals and means are. Only a minority of scholars have proposed the idea that shared communication or meanings are not necessary for effectively coordinated action. For example, Weick (1979) observes that the coordination of action
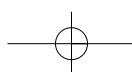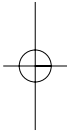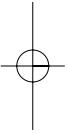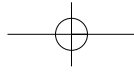
itself is more important than the coordination of meanings or beliefs for organizational functioning.

A more radical stance is that *unshared* understanding actually is essential for some pervasive forms of social life. Eisenberg (1990) is among the few communications scholars to have gone so far as to suggest that lack of shared understandings can enable more effective collaboration than shared understandings would. Likewise, Conrad (1985) points out that many organizations demand and reward people for 'closed' rather than 'open' communication. Indeed, it is not difficult to find organizations where protocols of secrecy and 'need to know' are the rule.

Benign, widespread but largely unremarked-on arrangements that depend on unshared understanding and limited communication are specialization, privacy, trust and politeness, to which we now briefly turn. Specialization is a social ignorance arrangement. The stereotypical explanation for specialization is that it arises when there is too much for any one person to learn. But viewed from a motivational or functional standpoint, specialization is an example of risk-spreading in three respects (Smithson, Chapter 18). First, no participant has to take on all of the risks of direct learning (versus vicarious learning, which is less risky). Second, the risk of being ignorant about crucial matters is spread by diversifying ignorance. And third, the risks associated with bearing knowledge (for example responsibility or culpability) are also spread.

Privacy is another socially mandated arrangement involving voluntarily imposed uncertainty and ignorance. Privacy has often been construed as control over access by others to information, mainly about the self (see Foddy and Finighan, 1980). As Warren and Laslett (1977) point out, privacy involves a consensual and essentially cooperative arrangement, whereas secrecy is unilaterally imposed. The usual motives for privacy are quite obvious, generally amounting to freedom from surveillance and exploitation.

Organized specialization and privacy, along with other consensual social ignorance arrangements, are entwined with trust. For instance, effectively functioning expertise requires that non-experts trust experts to warrant only the knowledge they possess and not to falsify evidence or conclusions within the scope of their expertise. Despite long-running debates about the nature of trust, there is widespread agreement among scholars that trust carries with it some form of risk or vulnerability. An important component of that risk is a requirement that the truster remain partially ignorant about the trustee. Trust relationships (for example friendships) entail a kind of privacy. If a person believes another is monitoring them or insisting that they self-disclose or account for their actions, that person will infer that the other does not trust them.

Polite social interaction is another important example of how social relations trade on ignorance. In polite conversation, conversationalists do not expect to deal in the truth, the whole truth, and nothing but the truth. Brown
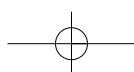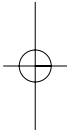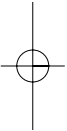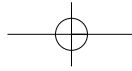
and Levinson (1987) elaborate various strategic requirements of politeness. As Smithson (1989) points out, those strategies often are achieved via disinformation (for example promoting a false impression of approval) or by referential abbreviation (particularly vagueness and ambiguity, as in tactful utterances).

The employment of vagueness and ambiguity in communication serves many of the same purposes in polite conversation that it does in organizational contexts where participants want to promote cooperative goodwill. We have already noted Eisenberg's (1984) claim about the use of ambiguity for achieving unified diversity, as in a working consensus or mission statement. Another strategic use is to enable deniability, for example the ability to claim that an interpretation which threatens to shame or anger someone was not the intended meaning of what was said. A third is increasing capacity for organizational change and adaptability by permitting diverse possible interpretations of organizational goals and rules while still appearing consistent. All of these are potential motives for employing vague or ambiguous communicative strategies.
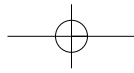
MORALS

It is practically a truism that motives are often justified by appeals to morality, but this does not detract from the importance of moral discourse in the management of uncertainty. Pickard's review (Chapter 5) of Towler's ideas about faith illustrates this very clearly in a religious context. The intriguing nub of these ideas is that faith is not certitude but is more like trust. Faith therefore embraces a kind of uncertainty, but it is a morally positive kind. Doubt is another kind of uncertainty, but doubting God's existence is a failure to trust and thus a kind of moral failing. In some traditional religious belief systems, such doubts are heretical. Different uncertainties may possess divergent moral qualities.

It might seem strange to search for moral judgements regarding uncertainty in domains such as physical measurement, probability or statistical theory; however, they are there. Perhaps the most obvious are moral judgements surrounding measurement (im)precision. After all, if the pursuit of truth and the elimination of disagreement are both good, then precise measurement also must be good. These Enlightenment ideals are exemplified by the assertion in Buckman's chapter (Chapter 6) that it 'is critically important, in drawing conclusions from them [experimental measurements], to know the extent of these inaccuracies and how they may be minimized'. A venerable ancestor is Gauss' (1809) argument that reducing the uncertainty of experimental results is 'uncontestably one of the most important tasks in the application of mathematics to the natural sciences' (cited in Olesko, 1995).

If measurements are not precise, then are there moral imperatives to let others know the degree of uncertainty attached to them? Professions such as engineering, medicine and law present an interestingly contingent set of answers to this question. For the affirmative case, the chapters by Jones (Chapter 23) and
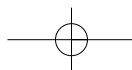
McFadden and colleagues (Chapter 22) both present illustrations of demands for estimates of reliability and/or precision of evidence. Likewise in medicine it is not difficult to find persuasive arguments for patients' rights to know the diagnosticity and sensitivity of medical tests. Longford's account (Chapter 19) of how the Admiralty Code is applied to the evaluation of evidence quality and Funtowicz and Ravetz's (1990) NUSAP scheme both propose injunctions for reporting uncertainty. 'NUSAP' is an acronym for number, unit, spread, assessment and pedigree. Number and unit pertain to the estimate and the scale involved. Spread incorporates error estimates (for example confidence intervals), but Funtowicz and Ravetz go further than this in recommending that expert evaluations of the quality and provenance of the estimate are also routinely reported.

However, there are also plenty of examples for the negative case. Medical practice has a long tradition of moral arguments for concealing from patients the true extent of medical uncertainties, and Plant's chapter (Chapter 4) contains several persuasive instances of this kind. Likewise, Jones's characterization (Chapter 23) of the legal profession's orientation towards specifying or admitting uncertainty includes strongly argued claims that the law would be brought into disrepute or stand accused of moral failing were it not to strive for truth and valid inference in every case brought before it.

What about probability or statistics? Consider Hájek's use (Chapter 8) of decidedly moral language in his observation that 'Radical subjectivism has been charged with being too permissive. It apparently licenses credences that we would ordinarily regard as crazy.' The scope of application for theories of probability undoubtedly involves moral evaluations. Likewise, statistical estimation presents moral quandaries. Consider two well-established estimation criteria: maximum likelihood versus unbiasedness. Maximum likelihood estimates are the 'most likely' given the evidence, but they often are not unbiased. Unbiased estimates are not always maximally likely. When both are available, on what grounds can we prefer one over the other? As a final example, human research ethics boards now routinely require research proposals to establish that their studies will possess sufficient statistical power to conclusively test their primary hypotheses.

The task of identifying moral concerns involving uncertainty becomes much easier if we replace the term 'uncertainty' with morally loaded equivalents such as 'freedom' or 'risk'. We focus on risk here. Risk carries considerable moral implications, which heavily depend on what is believed to be at stake. In Chapter 20, Handmer emphasizes the impact of political ideological pressures on emergency management, as does Furler (Chapter 16) in the public health domain. Moore (Chapter 15) also remarks on politicians' sense of 'a constant pressure that comes through the bureaucracy and through the media to give the appearance of doing "good" while at the same time minimizing risk'.

Risk assessment and management are therefore (among other things) moralizing undertakings. Even the source of risk has moral implications. Several
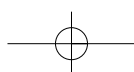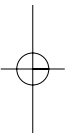
studies have found that uncertainties imposed by others are viewed as worse than 'natural' uncertainties, which in turn are worse than self-imposed uncertainties (or collectively mandated uncertainties). Perhaps the most vivid example of the negative moral associations with uncertainty imposed by others is the portrayal by McFadden and colleagues (Chapter 22) of terrorism as the promotion of uncertainty and fear as a method of achieving political ends.
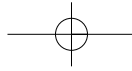
It is at this time a commonplace that Western societies have become much more preoccupied with and litigious about risk than in the recent past. If, as argued earlier, human beings need to make sense out of the unexpected, then part of that will involve moral judgements. One person's 'risk worth taking' may be another's 'culpable negligence'. Contemporary social norms and cultural climates are bound to influence such judgements in fundamental respects.

A widely cited example of the turn towards considering every unexpected harmful outcome as preventable is the editorial in the *British Medical Journal* (Davis, 2001) announcing a ban on the word 'accident' from its publication. The ban was predicated on the claim that 'most injuries and their precipitating events are predictable and preventable', with a clear implication that culprits can be found for every such injury. There are domains and contexts in which *no* risk is morally acceptable. Various commentators, including Furedi (1997), have attributed this shift to the emergence of a litigious culture. From our standpoint, this is a striking example of a purely moral justification for banishing (or denying) uncertainty. Further, as Handmer (Chapter 20) points out, banishing the term 'accident' leads to an unrealistic illusion of control.

Just as moral arguments are employed to justify uncertainty reduction, so they are often invoked to justify the maintenance of uncertainty or ignorance. Taboos are enforced initially by moral arguments. In Chapter 20, Handmer avers that, in emergency management, secrecy on the part of a stakeholder may be rationalized by appeals to 'national security' or 'commercial confidentiality'.

Many of the uncertainty trade-offs described in Chapter 2 and throughout the rest of this book invoke moral issues. Much of Furler's chapter (Chapter 16) elaborates various differences between the moral concerns of those in the 'political power' versus 'health' camps who are directing which uncertainties in the Australian public health system should receive highest priority. In a different but nevertheless familiar vein, the chapter by McFadden and colleagues (Chapter 22) explores the trade-offs between prioritizing security against terrorism and maintaining civil liberties in a directly parallel fashion to the debates in law about standards of proof (false convictions versus false acquittals).

A central point in Curthoys's review (Chapter 11) of controversies regarding uncertainty in history is that moral issues are at stake in the disputes between those who demand that history tell a 'single truth' and those insisting that history requires constant 'rewriting' and multiple viewpoints (some of which oppose one another). She also reveals a profound moral ambivalence among historians regarding whether truth-tracking is a legitimate goal in their profession, an

ambivalence paralleled in Perez's distinction (Chapter 13) between the constructivist and positivist approaches to complexity science.

Uncertainty itself is employed for moral justifications and appeals to legitimacy. It is used in various guises to justify inaction, maintenance of the status quo, opportunism, evasion of responsibility or culpability, and risk-management policies. However, justifications for actions and choices on the basis of ignorance abound in quotidian life as well. Johnson-Hanks's (2005) ethnographic research on southern Cameroonian women's intentions and actions regarding marriage and childbearing provides some vivid illustrations. Life under the 20-year economic crisis in Cameroon encompasses not only economic hardship but a 'generalized state of distrust' (p366). The extreme uncertainty associated with the crisis accounts for 'incompetence, graft, sexual infidelity, school failure, and even witchcraft'. It also legitimates the rejection of planning and ascription of intentionality to acts, various kinds of opportunism, and a type of fatalistic retrospective assent to whatever unfolds in life's course.

METAPHORS, MOTIVES AND MORALS IN THREE PROBLEM AREAS: COMMUNICABLE DISEASES, ILLICIT DRUGS AND ENVIRONMENTAL MANAGEMENT

We return now to the three problems presented in the core essays: controlling infectious disease outbreaks (Chapter 4), tackling illicit drug use (Chapter 14) and responding to environmental problems (Chapter 21). These problems present many illustrations of the motivational and moral considerations discussed thus far.

Controlling infectious disease outbreaks

Plant's account (Chapter 4) of the SARS 'outbreak' mobilizes the metaphorical underpinning of that word, not least by portraying the responses in terms of an 'army of people'. The primary motivational and moral concerns are to reduce uncertainty but also to make effective decisions even when uncertainties cannot be reduced. On the one hand, 'as a doctor, one is expected to have the answers that sick people need. When this is not possible, at a personal level it leads to a sense of failure […].' In addition to this powerful motivation, Plant conveys the sense of a moral imperative insofar as 'the characteristics and predisposing factors for the infection need to be investigated, as well as identification of the organism'.

On the other hand, there are strong moral injunctions for immediate decision and action: 'Despite these unknowns, we had to make decisions – who to admit to hospital, how to manage their clinical course, and how to advise their relatives or the health staff looking after them.' Likewise, a number of decisions she and her team are requested to make present important moral quandaries: 'Should a
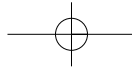
mother who has recovered from SARS breast-feed her child? … If a woman has SARS, should her husband be allowed to serve food in his restaurant?'

Plant's recollections also provide examples of motivational and moral conflicts entailed in dealing with uncertainty. For individual team members, urges to escape from the situation or to use authority and denial to avoid 'thinking the unthinkable' co-occur alongside 'camaraderie and sense of doing something good for others, as well as being on the front line of activity'.

Plant finds herself having to consider who should know which things about the outbreak and the lack of knowledge about it. She is guided by the belief that provoking anxiety is bad and reducing it is good, but also by awareness that every move by her and her team is being watched by key local people. She therefore is compelled to tread a fine line between panicking people by revealing the extent of the unknowns and triggering suspicions that they are not being told of the full extent of the risks posed by the outbreak.

Tackling illicit drug use

Ritter's chapter (Chapter 14) begins by laying out the complexities and uncertainties surrounding the heroin problem, all of which motivate uncertainty management and/or reduction. Decision-makers in law enforcement and health are strongly motivated to reduce uncertainties, given the absence of knowledge about such basic matters as the number of dependent heroin users and the direct consequences of law enforcement strategies. Even much of what is known about the effectiveness of attempts to deal with the heroin problem is 'negative knowledge' in the sense of knowing what does not work (for example many existing measures aimed at prevention).

Her analysis of the trade-offs in reducing one kind of harm versus another could also be applied to the question of which harms should be targeted for monitoring and data collection. It is difficult and expensive to measure the various harms from heroin, especially to non-users. The quandary posed here is that with limited resources and capabilities for assessing various kinds of harm, the decision to dedicate resources to one kind rather than another could depend upon whose harm and what type of harm you want to reduce. The nub of the quandary is that without carefully examining such motives, data collection and research could be driven in a self-confirming fashion by selectively reducing uncertainty about some harms while ignoring others.

Ritter's chapter also vividly portrays the clinician's motivational issues regarding the uncertainties of working with a heroin-dependent client who may be suicidal. Hers is a consequentialist account, focusing on the impacts of a false positive versus false negative diagnosis by the clinician, 'driven by the clinician's experience, degree of willingness to take risks, and assessment of the client and the seriousness of the presentation'.

Turning now to moral considerations, Ritter's first example problem, estimating the number of dependent heroin users, raises the previously
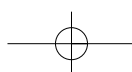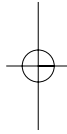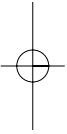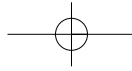
discussed question of moral imperatives to let others know the degree of uncertainty attached to such estimates. She cites the United Nations Reference Group on HIV/AIDS Prevention and Care, which has been collating global, regional and national estimates of the prevalence of injecting drug use and HIV infection, as utilizing a range of measures to deal with the uncertainty in estimates. These measures, such as obtaining a maximum and a minimum figure for each country and assigning quality ratings to estimates on the basis of the methods by which they are obtained, are akin to the recommendations from the NUSAP framework.

Interestingly, Table 14.1 in Ritter's chapter, containing estimates of the number of heroin users in the state of Victoria, exemplifies some of the issues in reporting uncertainties according to both standard statistical norms and more radical frameworks such as NUSAP. Some estimates are unjustifiably precise (for example '9483' and '6034'), and none of them indicate how much latitude for error there might be.

As in Plant's account, Ritter identifies a key moral imperative for clinicians as having to make decisions under great uncertainty: 'Predicting the likelihood of suicide is very difficult … [but the] clinician must make a judgement.' Consistent with her views on the motivating factors for clinicians in dealing with uncertainty, she has a consequentialist standpoint on the moral responsibility of the clinician for client outcomes even in the face of unforeseeable developments: 'The duty of care then returns to the clinician.'

Ritter's description of clinicians' objections to the evidence produced by Meehl and others (see, for example, Grove and Meehl, 1996) regarding the superiority of statistical models over clinical judgement in predicting client outcomes hints at a moral component to their resistance. Meehl's algorithmic prescription could be seen as a morally unacceptable relinquishment of professional responsibilities. If so, that contrasts in an intriguing way with the acceptance of algorithms in other professional domains such as engineering or accounting.

Among the most interesting moral aspects of uncertainty in Ritter's chapter are those pertaining to policy formation and change. In her account, the extent of uncertainty has direct bearing on the legitimacy of policymaking options. This claim hearkens back to earlier remarks in the present chapter concerning the use of uncertainty for moral justifications and legitimation. In line with those remarks, Ritter points out that a high level of uncertainty may lead to 'a sense of paralysis, where no decisions are made beyond the status quo'. Moving beyond this observation, she then notes that uncertainty can be advantageous for the politician and enabling for the policymaker, because a weak evidence base cannot dictate which policy is best. Thus politicians can argue for different policies on different occasions to match their audience, and the policymaker 'has the freedom to explore and implement a raft of policies'.
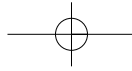
Responding to environmental problems

Dovers and colleagues (Chapter 21) begin their discussion of resource and environmental policy and management by describing how this domain has expanded to include a wider array of environmental resources, the management of people and their interactions with natural systems, and a considerably longer time-span of concern. These expansions have compelled practitioners to abandon the kinds of uncertainty-banishing available to them when their domain was narrower and more specialized. A major theme of the chapter is that sustainability problems are different in kind from conventional problems facing policy-oriented professions and demand new 'forms of knowledge and policy responses'.

Some of the motivational forces they describe resonate with those mentioned by Ritter and Plant, as discussed above. Thus they refer to the need to form policies and make decisions rapidly with the prospect of irreversible impacts, far-reaching consequences and system threshold effects. However, they note that these prospects do not justify an aversion to change, but instead warrant an acknowledgement of the dynamic nature of the systems being dealt with and of the knowledge base.

Perhaps not surprisingly, those motivational influences incline Dovers and colleagues towards precautionary practices, monitoring systems, 'adaptive management' and evaluating policies to a greater extent than predicting future systems behaviour and long-term planning of the traditional kind. The wider concerns of their profession have motivated seeking multiple sources of information and views on risk, multiple methods of impact assessment and inference, and dialogue with multiple stakeholders regarding strategic options.

Dovers and colleagues characterize their profession as guided by an over-arching moral goal: 'Sustainability is best understood as a higher-order social goal akin to other such goals like democracy, justice or the rule of law.' It follows that their profession is located in something of a minefield of potentially conflicting imperatives regarding uncertainty. On the one hand, for example, there are urgent calls for uncertainty reduction on many fronts. On the other, there is the imperative not to wait for uncertainty reduction in the form of the precautionary principle. According to this principle, where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation. Another example is the requirement to adhere to currently endorsed prescriptive specifications such as the Australian/New Zealand Standard 4360 of Risk Management, while recognizing the 'paucity of uncontested or well-developed research methods, policy instruments and management approaches'.

Finally, even the universal endorsement of community participation in risk assessment and environmental management brings together previously unconnected values and interests. These in turn add new moral dimensions to debates about uncertainty and acceptable ways of coping with and responding to it.
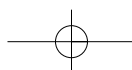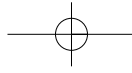
CONCLUSION

By now it should be clear that people bring divergent motives to bear on uncertainty. We have encountered motives for maintaining or creating uncertainty as well as for reducing or banishing it. Most of these motives are based on moral positions and concerns, which likewise may compete with one another. This is not a case of 'good' versus 'bad' motives; it is good versus good. Appeals to reducing or banishing uncertainty can be made in the name of the pursuit of truth, protection of the vulnerable, insurance of safety, enforcement of transparency and accountability, or establishment of binding agreements. However, appeals against uncertainty reduction can be argued on the basis of building certain kinds of social capital (for example trust, privacy or civility), excessive cost, avoiding the violation of rights, or even maintenance of religious faith. Given these diverse and competing motives and morals, it should come as no surprise that there are essential tensions between various alternatives for coping and managing under uncertainty. Those alternatives and the prescriptions underlying them are the topic of the next chapter.

NOTE

1   The Goolabri Group are Robyn Attewell, Stephen Buckman, Ann Curthoys, Kate Delaney, Stephen Dovers, Liz Furler, Sasha Grishin, Alan Hájek, John Handmer, Judith Jones, Steve Longford, John Mackey, Michael McFadden, Michael Moore, Paul Perkins, Pascal Perez, Stephen Pickard, Aileen Plant, John Quiggin, Alison Ritter and Ian White.
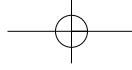
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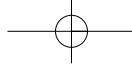
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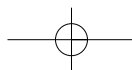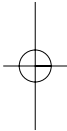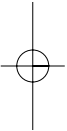
Coping and Managing under Uncertainty

Michael Smithson, Gabriele Bammer and the Goolabri Group[1]

## INTRODUCTION

As pointed out in Chapter 2, uncertainty presents us with the following adaptive challenges:

1   dealing with unforeseen threats and solving problems;
2   benefiting from opportunities for exploration and discovery;
3   crafting good outcomes in a partially learnable world; and
4   dealing intelligently and sociably with other people.

Chapter 2 also referred to conflicting interests and dilemmas that arise in dealing with uncertainty. We will explore these issues further in this chapter, although we will stop short of dealing with methods per se. An investigation of methods for managing uncertainty would require a book of its own.

First, several contributors make it clear that a starting point in their enquiries, practice or problem-solving includes deciding what to do about uncertainty. Handmer, for example, says a 'fundamental question for emergency management is whether to embrace, deny or seek to reduce uncertainty' (Chapter 20). As pointed out in Chapter 2, strategies for managing under uncertainty typically have specific orientations. One set of issues concerns understanding and representing uncertainty. Understanding uncertainty may involve estimation, causal reasoning and a variety of other sense-making exercises. Probability theory is an example of a framework for understanding particular kinds of uncertainty, and uncertainty representations can range from quantitative or mathematical to verbal or narrative. The second set of issues pertains to whether to act or not in response to uncertainty. These issues raise
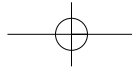
questions of how uncertainty can be:
- denied (said not to exist);
- banished (set aside as being 'out of bounds' and not dealt with);
- reduced (usually by gaining more knowledge);
- accepted or tolerated;
- surrendered to; and
- controlled, harnessed or exploited.

UNDERSTANDING AND REPRESENTATION

Starting with the issues of understanding and representation (we focus mainly on representation here): Why are people interested in representing uncertainty? Two chief motivations emerge from the chapters in this book. One interest is in being able to reason about uncertainty. Attewell (Chapter 7) dwells at length on the contributions made by statistical reasoning to a vast array of research and problem areas and Buckman (Chapter 6) highlights the role of probabilistic reasoning in modern physics. Hájek's review of the major debates about the proper subject matter of probability theory (Chapter 8) sheds light on a related and still unresolved question: What kind(s) of reasoning can we do about uncertainty? Is probability the only alternative or are there other valid frameworks and, if so, which should be used under what conditions? Smithson's chapter on psychological research into human reasoning under uncertainty (Chapter 18) describes a long-running debate over whether the departures of people's heuristic short cuts and mental representations of uncertainty from the strictures of probability theory are necessarily irrational or maladaptive.

A related issue is establishing criteria for how much and what kind(s) of uncertainty may be legitimate or tolerated. Dovers and colleagues (Chapter 21) observe that, in environmental management, very different burdens of proof are applied by scientists, the courts, economists, local residents and the media. An adequate representation (often quantification) of uncertainty is required to enable criteria to be meaningfully posed, let alone debated.

The second motivation for representing uncertainty, whether quantitatively or otherwise, is to communicate about it. People will not be able to agree or disagree about uncertainties unless they have a common language for discussing them. Longford (Chapter 19) makes this motivation explicit in his rationale for the Admiralty Code, which 'allows the recipient of a piece of information to weigh it in terms of value in a reliable and valid manner that allows others to understand what that weight or value is at any point in the future'. Plant (Chapter 4) places the communicative motives front and centre in dealing with an unknown infectious disease: 'A major challenge is dealing with the balance between truth and rumours, as well as the role of the media in provoking or relieving anxiety.'
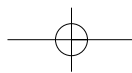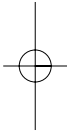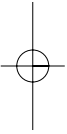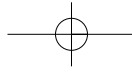
Representations of uncertainty for communicative purposes open the way to influencing others' perceptions of uncertainties and thereby meeting the fourth adaptive challenge of dealing intelligently and sociably with other people. Attewell's mission statement (Chapter 7) for statisticians is 'not to devise more efficient or elegant theory, but to sell the solutions we already have'. Handmer (Chapter 20) lists several strategies employed by emergency managers to influence public perceptions by manipulating or creating uncertainty: 'by hiding or distorting information, … by denial, by being ambiguous or vague, by creating misleading impressions, or by undermining and thereby casting doubt on the arguments of others'. A crucial element in Delaney's description (Chapter 12) of how futurists work is their efforts to alter their clients' perceptions of future possibilities, opportunities and uncertainties by way of encouraging them to 'consider not only likely or obvious outcomes, but also unthinkable ones'.

Intuitively, acquiring a good understanding of uncertainty seems to be a prerequisite for coping with it. However, several examples in the contributions to this volume diverge sharply from this view. Mackey (Chapter 9) aptly observes that musical improvisation is akin to social conversation: both of them involve communicating and responding to what has been communicated with very little, if any, attention to uncertainty per se. Likewise, Grishin's description of Wolseley's artistic practices (Chapter 10) makes it clear that the artist is not usually engaged in understanding uncertainty itself, but instead is interacting with the world around him and working with whatever nature and time present him with. Nor is this short-circuiting of uncertainty limited to the arts. As Handmer points out (Chapter 20), emergencies involve four aspects: prevention, preparedness, response and recovery. The latter two often do not involve considerations of uncertainty; they are post-event reactions. Emergency managers are often not required to understand or represent uncertainty per se, but instead to effectively respond to it.

Understanding and representing uncertainty can also be difficult goals to attain, and it is possible to succeed in one while failing at the other. Hájek's exploration of the philosophy of probability (Chapter 8) exemplifies this issue when he reveals that the mathematical question of how to work with probabilities (representing and computing with them) is much more settled than the philosophical question of what probabilities are and what they are not. Delaney's discussion (Chapter 12) of the role of worldview in constraining our understanding of future possibilities makes the analogous point that clear representations of future possibilities may not enable planners to see an emerging novel reality if they are 'locked inside obsolete assumptions'.

RESPONDING TO UNCERTAINTY

Let us return now to Handmer's question (Chapter 20) for emergency managers: What should be done about uncertainty? In some domains the answer to this
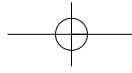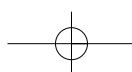
question seems to be grounded in fundamental assumptions. Longford's chapter on intelligence (Chapter 19) and Jones's on law (Chapter 23), for example, repeatedly state that the goal in their respective fields is uncertainty reduction. Jones also finds a great deal of uncertainty banishment and denial in legal practices. In economics, Quiggin (Chapter 17) discusses analyses of the factors producing high levels of stock-market volatility and periodic bubbles and busts, with a goal 'to suggest innovations in government policy and new financial instruments that might improve the spreading of risk and reduce excessive volatility', in other words uncertainty reduction again.

Perez (Chapter 13), on the other hand, argues that in complex adaptive systems uncertainty reduction is impractical and even beside the point. The dominant stance in his discipline is one of tolerance and acceptance of irreducible uncertainties. Nevertheless, there is also an element of relinquishment or even ineffability in his anti-reductionist stance. A similar element is echoed in Curthoys's characterization (Chapter 11) of the Foucauldian view that history is replete with irreducible uncertainties: 'the historian, like the past, is not unified within himself; he is not a sovereign subject whose consciousness is fully knowable to himself. He can neither master knowledge of the past, nor write from complete self-knowledge, for the historian's own historical consciousness is never whole.' In a more openly moral vein, Pickard (Chapter 5) avers that the desire for certainty may be pathological; for him, 'finding a way to live with uncertainty may be a therapeutic response drawing on the deeper resources of humanism and religion'.

Living with uncertainty inevitably raises issues of getting things done with it, in other words harnessing or exploiting it. The notion of harnessing or exploiting uncertainty tends to bring to mind 'dark' images such as political machinations, advertising campaigns, or other examples of one group creating uncertainties in another and gaining advantages thereby. To the examples from Moore's chapter on politics (Chapter 15) we may add the starting point for the chapter by McFadden and colleagues (Chapter 22): 'Terrorism is particularly relevant to the general study of uncertainty because its key modus operandum is to create fear and uncertainty in the general community with the aim of increasing the likelihood of achieving its political goals.' Knowledge may or may not be power, but differentials in knowledge almost certainly confer power (but also frequently accountability and culpability) on those 'in the know'. Nevertheless, exploiting other people's ignorance is not the only way in which uncertainty can be put to use.

Benign examples of harnessing and exploiting uncertainty are somewhat more subtle but not difficult to find. The widespread use of so-called random number generators is a case in point. Random number generators are used to simulate random processes in computer programs, various applied mathematical or computational solutions to complex problems, and even art and music. Random assignment in experimental studies is a striking example of how one kind of uncertainty (random differences between experimental conditions) is adopted in preference to another (confounding differences between conditions due to unsuspected biases in assignment).
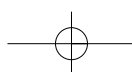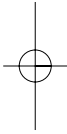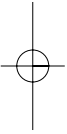
The notion of exploiting uncertainty is closely allied with the second adaptive challenge, namely benefiting from opportunities for exploration and discovery. Mackey's and Grishin's chapters (Chapters 9 and 10) stress the creativity that can be released through actively sought and embraced uncertainty. As Grishin points out, the Dadaists discovered in 'chance' the means to new techniques for generating art (for example found objects, ready-mades and collage) and these in turn 'restored the sense of the primeval magic power and the numinous quality of art'.
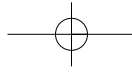
A number of disciplines and practice domains are understandably beset by disagreements over what can and should be done about uncertainty. In some areas, the conflict revolves around which uncertainties are the most important. Furler (Chapter 16), for example, characterizes the domain of health in public administration as an arena for a clash between different approaches to managing uncertainty, hinging on whether political uncertainties or uncertainties about public health dominate as the primary concerns in the public service.

In other areas the conflict is at a more conceptual level, stemming from disagreements over what can and should be done with uncertainty. Thus Quiggin (Chapter 17) describes two camps in economics as 'polarized between advocates of formal decision theories, who claim that uncertainty can be tamed by careful consideration of information and elicitation of preferences, and critics who argue that uncertainty is fundamentally irreducible'. Curthoys (Chapter 11) abundantly demonstrates this for historical scholarship, wherein history 'has a double character, as both science and narrative art, and as such will continue to be torn between the two'. In a different vein, Grishin (Chapter 10) mentions an ongoing polarity between the rhetorical idealization of the artist surrendering to uncertainties and typical artistic practice in which tensions remain between the artist's quest for technical facility and the interposition of external impacts on the artwork.

Likewise, Perez (Chapter 13) describes the ongoing controversy in complexity science, the core of which is a long-running debate over the limits of 'positivist' or 'normal' science. Positivism has multiple meanings in these debates, but here positive science may be taken to mean, as Medawar (1967) puts it, 'the art of the soluble'. In complexity science one camp claims that the study of complex adaptive systems can be effectively carried out as a positive science, with wholehearted scientific inductivism, deductive proofs where mathematics is involved and objective understandings. The other camp dissents from this, claiming that the uncertainties in complex adaptive systems are not reducible by normal scientific methods and that a new kind of science is required that relinquishes some of the normal scientific claims such as objectivity or experimental control.

Even in the absence of such conflicts, preferences regarding coping strategies for dealing with uncertainty may change according to the extent to which people feel under threat or siege. The first adaptive challenge described at the

beginning of this chapter identifies threats and problems as the focus, and these tend to motivate banishment and reduction. Pickard (Chapter 5) summarizes a pertinent thesis from Toulmin (1994), who pointed out a correspondence between toleration of uncertainty in religious thought and the state of the economy during the emergence of modern religion and science in Europe. During prosperous times, pluralism and uncertainty both were viewed as affordable and tolerable. However, economic crises brought about an intellectual 'climate marked by aversion to speculation, preference for abstract and timeless propositions, disconnection from context, and resistance of certainties to interrogation or revision'.

Finally, let us return briefly to the competing interests between researchers and consultants mentioned in Chapter 24. Researchers focus on the gaps in knowledge and inconsistent or unclear aspects of concepts. Consultants, on the other hand, are geared toward synthesis and decisiveness. To this we may add other important stakeholder interests: entrepreneurs wish to find or generate uncertainties in the form of opportunities and freedom to create wealth; politicians may not want their electioneering promises or goals to be entirely explicit or measurable (see Moore, Chapter 15). Both of these interests conflict with those of regulation or scientific research. It is often forgotten that many calls for uncertainty reduction or elimination are implicitly limited to reducing uncertainty about anything but oneself. Incompatibilities among these interests can generate heated conflicts in problem areas or practice domains.

Such conflicts can reach right down to questions of whether obtainable data should be collected and, if so, to whom they should be available. When the existence of data is linked with issues of secrecy, it is difficult for relevant parties to ascertain whether data exist and, if so, how extensive or informative they are. For example, Ritter (Chapter 14) observes that the evidence base for the effectiveness of law enforcement in discouraging heroin use is scant. Indeed the dearth of published articles containing statistical analyses of data adequate for addressing this issue (see Smithson et al, 2005) arises from the fact that the purity levels of heroin seized by law enforcement agencies are rarely measured, which in turn attests to complex political issues.

ORIENTING STRATEGIES

The foregoing material suggests a number of orienting strategies regarding uncertainty, and a synthesis of these is attempted here. First, we may distinguish two contrasts regarding epistemic orientations towards uncertainty:

1 uncertainty as 'out there' versus 'in here' (objective versus subjective); and
2 uncertainty as quantifiable or finitely describable versus ineffable.
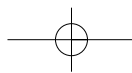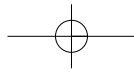
Epistemic orientations directly influence how uncertainty is understood and represented, and many debates about uncertainty boil down to disagreements over one or both of the contrasts listed above. In the domain of risk analysis alone, we can see major shifts and arguments in the past two decades with respect to both contrasts. Risk assessment has moved from being almost entirely dominated by the view that uncertainty is external, objectively comprehensible and able to be quantified, to a view that accords much more importance to social constructions, subjective appraisals, qualitative and narrative accounts, and context dependence (see, for example, Pidgeon et al, 2003, pp1–10).

Second, we may distinguish among the reactive stances adopted towards uncertainty. We have already seen that uncertainties may be framed negatively or positively. In Chapter 2 the point was made that Western culture predisposes people to view it negatively, but does have room for considering uncertainties as freedoms and opportunities. Uncertainty framing also entails stances regarding human agency in the production of and response to uncertainty. Uncertainty may be actively sought (as in scientific discovery), deliberately generated (as in artistic creativity), voluntarily accepted (as in hazardous recreational sports or decisions not to acquire information that is too costly) or imposed (as in emergencies or disasters).

Finally, five coping strategies (denial, banishment, reduction, tolerance and relinquishment) may also be distinguished in terms of their background orientations towards control. Wildavsky (1985) borrowed terms from ecology to characterize two kinds of control orientation. Anticipation involves prediction and planning on the basis of forecasts, and therefore is served by uncertainty banishment and reduction. Resilience, on the other hand, involves ensuring that systems are robust and flexible to survive unforeseen problems or disasters, and therefore is compatible with tolerance of uncertainty. It is arguable that relinquishment is tantamount to abandoning control, so we accord it a category of its own. To sum up, we have the following distinctions:

1   Valence:
    •   negative: uncertainty as threat or risk;
    •   positive: uncertainty as freedom or opportunity.
2   Human agency, with uncertainty:
    •   actively sought;
    •   voluntarily accepted; or
    •   imposed.
3   Coping strategy:
    •   banishment (anticipatory control orientation);
    •   reduction (anticipatory control orientation);
    •   tolerance (resilience control orientation);
    •   relinquishment or denial.
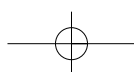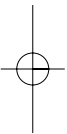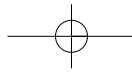
Table 26.1 *Human agency and control orientation in responses to uncertainty*

	Uncertainty and perceived human agency		
Control orientation	*Actively sought*	*Voluntarily accepted*	*Imposed*
Anticipation (banishment or reduction)	Randomized assignment in experiments	Subjective probabilities in decision-making	Statistical forecasting
Resilience (tolerance)	Musical improvisation	Complex adaptive systems management	Precautionary principle
Relinquishment or denial	Aleatory influences in visual art	Some versions of constructivism	Fatalism, relativism

Table 26.1 cross-tabulates human agency and control orientation, with examples briefly described in each cell.

DEALING WITH UNCERTAINTY IN THREE PROBLEM AREAS: COMMUNICABLE DISEASES, ILLICIT DRUGS AND ENVIRONMENTAL MANAGEMENT

We return once more to the three problems presented in the core essays: controlling infectious disease outbreaks (Plant, Chapter 4), tackling illicit drug use (Ritter, Chapter 14) and responding to environmental problems (Dovers et al, Chapter 21). This time we review the stances adopted towards uncertainty and the devices, strategies and methods used in managing it.
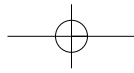
Controlling infectious disease outbreaks

In Plant's account (Chapter 4) of the SARS outbreak, the predominant orientation towards uncertainty, understandably, is imposition from external forces. Despite knowing virtually nothing about the new disease, 'we had to make decisions – who to admit to hospital, how to manage their clinical course, and what to advise their relatives or the health staff looking after them'. In the course of rapid decision-making under pressure and nearly total ignorance, three coping themes consistently recur: banishing uncertainty (in the immediate term), reducing uncertainty (in the longer term), and reducing fear and anxiety.

The medical team banished uncertainty in various ways for themselves and for those who sought advice from them. They set aside uncertainty for themselves in the immediate term by seizing on analogues with known diseases:

> *For example, we considered that the SARS organism was most likely a virus and spread predominantly via the respiratory route. Hence we acted as though that was true, meaning that infection control, patient management, patient*
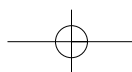
> *isolation and so on were all treated as though the (assumed) virus causing*
> *SARS was similar to other viruses.*

This is an example of *recognition-primed* decision-making, an effective heuristic by which experts can make choices rapidly in novel situations. Less functionally, some of them banished uncertainty by fleeing or attempting to exert force through authority.

Plant's account also mentions some personnel falling prey to denial. But she also describes lesser and undoubtedly functional forms of denial that amount to temporary distractions and reassurances, such as turning to 'normal' routines and comforts, or seeking news from home and the company of familiar people.

Correspondingly, the team banished uncertainty for laypeople in at least three ways. Initially, laypeople were given very definite advice about what actions to take, with the strategic intention of allaying fears in the short term and also probably preventing further spread of the disease. Second, key information brokers occupying positions of authority in the community (for example the principal of the International School) were primed with appropriate messages and advice to convey to their constituents. Third, the media were strategically presented with daily press releases and press conferences at crucial points. Interestingly, at times the key information brokers and/or the media were provided with fully honest messages about the extent of uncertainties, suggesting that the team blended strategies for dealing with the public.

Uncertainty reduction, according to Plant, was spearheaded by scientific research efforts. Nonetheless, she also highlights some non-scientific uncertainty-reducing tactics and heuristics, such as breaking uncertainties into small 'blocks' pertaining to specific issues or tasks.

Although the longer-term control orientation in a disease outbreak includes both anticipation (for example forecasting and prevention) and resilience (for example the use of broad-spectrum antibiotics), an important emerging theme in Plant's account is resilience in the face of nearly overwhelming uncertainties. We have here very clear examples of uncertainty banishment and reduction in the service of enhancing the ability of the medical team and the public to cope and strengthen their resilience, regardless of what the disease may turn out to be.

Tackling illicit drug use

Ritter (Chapter 14) focuses on three aspects of the heroin problem that involve managing under uncertainty: estimating the number of heroin users, policy formation and the treatment of a potentially suicidal dependent user. Estimating the number of users is an exercise in uncertainty reduction, and Ritter highlights the difficulties in achieving anything like a precise estimate. In this domain there are interests that militate against uncertainty reduction, not least of which is the reluctance of drug users to identify themselves as such to the authorities. Nevertheless, the resulting variability in estimates is a striking example of how
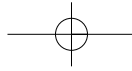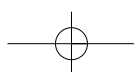
even a failed attempt at uncertainty reduction can yield useful knowledge about the extent of our uncertainty.

Policy formation typically involves a mixture of anticipatory and resilience stances towards managing uncertainty. Ritter's treatment of policy formation reveals problems in cost–benefit analysis, one of the more popular approaches to policy development. Perhaps the most obvious problem is inherent in the nature of trade-offs: that decreasing one type of harm may inadvertently increase another type. Another issue is the plurality of values and moral stances regarding drug usage throughout the community. As Ritter points out, we would have rather different policies if the primary goal were reducing harm to the community instead of to the individual, or if we considered harm to users to be good.

But a deeper problem is the assumption that all types of harm may be traded off against one another. Ritter deals with this assumption implicitly in her discussion of the difference between a consequentialist and deontological approach to heroin as a harmful substance. When human rights or sacred values are brought into the debate, for instance, they introduce matters that cannot be traded or negotiated. The right of an unborn child to not be exposed to the risk of being born with a heroin dependence is an example of a potential harm that is non-negotiable in some quarters. Non-negotiability lessens the capacity to form flexible or resilient policies, but is essential to the protection of rights or sacrosanct values.

In her portrayal of the clinician's situation in dealing with a potentially suicidal heroin user, Ritter refocuses the sense of agency from imposed uncertainty to voluntarily accepted uncertainty, at least for the clinician. By taking on a heroin-dependent client, the clinician willingly (if with some trepidation) chooses treatments and other courses of action knowing that he or she is taking risks. In fact, the clinician makes these decisions in the face of largely inestimable risks, especially regarding the probability of suicide.

Ritter draws our attention to the intriguing debate initiated more than 50 years ago by Meehl's (1954) book on actuarial versus clinical prediction. In this debate we may find excellent examples of the conflictive orientations towards uncertainty reduction that influence even highly informed specialists. On the one hand, empirical evidence compiled in more than a hundred studies overwhelmingly supports Meehl's original claim that actuarial formulas predict client outcomes more accurately than clinicians do. On the other, clinicians are reluctant to entrust life-and-death decisions to an algorithm. There is a parallel debate in medical diagnosis that has resulted in limited acceptance of artificial intelligence engines for medical diagnosis functioning alongside medical experts. The arguments described in Smithson's chapter (Chapter 18) over bounded rationality in human decision-makers versus the rationality requirements of formal decision theory bear on this debate as well. Many clinicians would argue, with some justification, that they must make therapeutic judgements and

decisions in the face of uncertainties that cannot be translated into the expected utility framework of formal decision theory.
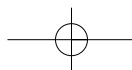
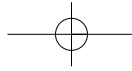### *Responding to environmental problems*

Returning finally to the chapter by Dovers and colleagues on the environment (Chapter 21), we find the authors characterizing their problem domain as having undergone major transformations in recent times regarding orientations towards both uncertainty and control. They claim that this transformation is largely driven by a shift from narrow, relatively short-term concerns with conservation of particular species and environmental protection versus economic development, to broader, longer-term and harder problems of managing large-scale environmental-social issues and integrating environmental protection and development interests. This shift has considerably broadened and deepened the nature of uncertainties that environmental managers and policymakers must deal with. But how has it affected orientations towards uncertainty and control and/or strategies for dealing with those uncertainties?

First, Dovers and colleagues point out that their domain has expanded from considering only uncertainties imposed externally to incorporating those generated and voluntarily accepted by people. 'Uncertainty does not simply exist "out there in the environment", but is constructed and negotiated in human society.' A reorientation towards including human agency in the construction of uncertainties entails a realization that, as Wynne (1992) observed, policy or technological commitments formed under uncertainty are likely to yield increased uncertainty, despite an original intention to reduce uncertainty via those commitments.

Second, the authors point to a shift from banishing those uncertainties outside narrow specialized interests to including them and attempting to work with them, even within specialities: 'The scope of risks under consideration has increased from quantitative risk, towards including residual uncertainty, qualitative approaches to risk assessment and a wider array of forms of uncertainty.' This enlarged scope has led to an increased realization among risk assessors and managers that 'making believable predictions of future conditions [is] extremely difficult' and that meaningful probability distributions (or even second-order distributions) cannot be constructed. Moreover, in many instances, 'not even the broad directions of change are known' and 'thresholds [of dramatic change] and surprise are understood as likely'.

Thus longer-term and broadened concerns that include human influences tend to defeat wholehearted forecasting or even the quantification of uncertainties. While the response to this quandary has resulted in a creative upsurge of work on methods and tools for risk assessment and discourse, 'no cross-disciplinary consensus exists on the efficacy of specific tools or how to choose from the toolkit'. Dovers and colleagues also raise concerns regarding differing views on burdens of proof and other criteria for 'good' decisions under uncertainty.

Persistently defeated attempts to forecast and quantify change and uncertainty have motivated a corresponding shift in control orientation from a solely anticipatory to a more resilience-oriented managerial style. This can be seen in the increasing emphasis on resilient strategic elements such as biodiversity, negotiable values and trade-offs, and contestable goals. Dovers and colleagues are cautious even about the prospects of achieving resilience, however, warning that 'institutional and policy reform to create more resilient, robust and adaptable capacities is in itself something to be approached in an explicitly experimental fashion'.
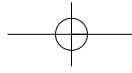
Their proposed 'adaptive management' approach frames management interventions as 'hypotheses to allow action while also informing structured learning over time'. However, the realization of this proposal is hampered by several impediments. Dovers and colleagues cite two kinds of hindrance. The first appears to be exigencies that simply must be dealt with as they arise. Examples of this kind are changes in government due to elections, scientific discoveries, unforeseen environmental events or changes, and, of course, unforeseen policy failures. The second kind may be reducible or redeemable, and these seem to comprise the focus of calls for reforms by Dovers and colleagues. Examples of these include fragmentation among disciplines and domains of expertise, lack of coordination across policy and governmental sectors, lack of commitment to long-term monitoring and learning, and insufficient lead-in times for public debate on policy proposals.

CONCLUSION

It has been necessary to simplify most of the matters covered in this chapter, especially regarding the coping strategies and control orientations towards uncertainty. The framework presented here is not intended to convey the impression that people use only one coping strategy at a time. Professional researchers or practitioners dealing with complex uncertainties seldom resort to a single strategy or control orientation. As is apparent in all of the chapters in this volume, they employ sophisticated combinations of these, often adroitly switching among or blending them as required.

Perhaps the most important point of this chapter is that any of the coping strategies may be adaptive or maladaptive under the right circumstances. We have seen how denial and banishment can be adaptive, at least in the short term, for dealing with extreme threats that otherwise would induce panic, despair or paralysis. Likewise, we have seen that uncertainty reduction is not always adaptive; it can be too costly, take too much time or even destroy social capital. There is no single recipe for dealing effectively with uncertainty. In the decision sciences, where human responses to uncertainty have been studied for more than half a century, only recently has appropriate attention been focused on understanding the variety and complexity of coping strategies that people bring
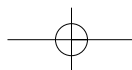
to bear on uncertainty. Advancing that understanding is one of the chief goals of this volume and a research topic with immense potential.

NOTE

1   The Goolabri Group are Robyn Attewell, Stephen Buckman, Ann Curthoys, Kate Delaney, Stephen Dovers, Liz Furler, Sasha Grishin, Alan Hájek, John Handmer, Judith Jones, Steve Longford, John Mackey, Michael McFadden, Michael Moore, Paul Perkins, Pascal Perez, Stephen Pickard, Aileen Plant, John Quiggin, Alison Ritter and Ian White.

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