

## **Ignorance and Uncertainty: Emerging Paradigms**

Michael Smithson

### **Chapter 1:**

#### **A Vocabulary of Ignorance**

"...as a corollary to writing about what we know, maybe we should add getting familiar with our ignorance, and the possibilities therein for ruining a good story."  
Thomas Pynchon.

##### **1.1 Ignoring Ignorance**

Until recently, ignorance and uncertainty were neglected topics in the human sciences and even in philosophy. Even now, they do not share center stage with knowledge in those disciplines, but remain sideshow oddities for the most part. Instead, Western intellectual culture has been preoccupied with the pursuit of absolutely certain knowledge or, barring that, the nearest possible approximation to it. This preoccupation is worth investigating, since it appears to be responsible not only for the neglect of ignorance, but also the absence of a conceptual framework for seriously studying it. Accordingly, in this section I will briefly outline the orientations in Western science and philosophy which have motivated the neglect of ignorance. I will also take the position that these orientations have begun to change recently, and that one of the spinoffs has been an unprecedented interest in ignorance, uncertainty, and related topics.

Ignorance usually is treated as either the absence or the distortion of 'true' knowledge, and uncertainty as some form of incompleteness in information or knowledge. To some extent these commonsense conceptions are reasonable, but they may have deflected attention away from ignorance by defining it indirectly as nonknowledge. From at least the time of Plato, Western philosophers and scientists have worked as if infallible, demonstrable knowledge were an attainable goal. Modern epistemology notwithstanding, vestiges of the Thomistic distinction between "scientia" and "opinio" remain with us, and the most common approach to ignorance has been either elimination or absorption by exercising some version of the 'scientific method'.

The dominant traditional methods for acquiring justified beliefs or making 'rational' decisions are predicated on the twin goals of complete information and absolute epistemological standards for transforming that information into knowledge and thence into appropriate action. Good information and true knowledge are nearly universally treated as desirable, even scarce, commodities. While not everyone goes as far as Samuel Johnson's declaration that all knowledge is of itself valuable, even the most hard-headed pragmatist prefers knowledge to ignorance if no cost is entailed in obtaining either. Prior to any commitment to decisions or actions, almost all Western intellectual traditions direct us to maximize information and/or knowledge, and so reduce uncertainty or ignorance.

It is therefore no accident that theories of knowledge far outnumber those of ignorance. This is so for both normative and explanatory perspectives. The 1967 *Encyclopedia of Philosophy*, for instance, has no major headings for "ignorance" or "uncertainty" although it does for "vagueness", "skepticism", "error", and "doubt". The tone in these sections is prescriptive and corrective. The dominating assumption appears to be that ultimately vagueness and error are corrigible, and that radical skepticism or doubt are impossible or destructive attitudes. The only framework for

dealing with incorrigibly or irreducibly incomplete knowledge that gets an airing in this authoritative sourcebook is probability theory, which has been the landmark normative paradigm of its kind for three centuries.

Unger (1975) has observed that ordinary language is more direct and clear in matters of fact and knowledge than it is in ignorance. While we may say "Joe knows that Clara is pregnant" we cannot express ignorance in a similarly direct way. To phrase ignorance in the active voice we must use negation ("Joe does not know that Clara is pregnant"). The sole active voice construction for ignorance does not merely indicate a state of nonknowledge. The statements "Joe ignores Clara's pregnancy" or "Joe ignores the fact that Clara is pregnant" fails to convey the simple opposite of knowledge about Clara's pregnancy. A passive voice construction for ignorance is possible, but even then it is not as direct as its knowledge-oriented counterpart. Compare "Joe is informed that Clara is pregnant" with "Joe is ignorant of the fact that Clara is pregnant". To omit the italicized words in the second sentence makes it a deviant construction in English.

The human sciences are no less biased in favor of discussing knowledge rather than ignorance. While knowledge itself often has formed subfields in psychology, sociology, and anthropology, ignorance traditionally has not. Thus, for instance, there is a sociology of knowledge but no sociology of ignorance (proposals have been made for a "sociology of nonknowledge" (Weinstein and Weinstein 1978) and a "social theory of ignorance" (Smithson 1985), but these remain outside mainstream theory). Most explanatory accounts from the human sciences treat the latter marginally or implicitly if at all, and often negatively (usually in reference to their supposedly destructive consequences for human social or mental functioning). In psychology the traditional interests have been directed towards performative models of human cognition and intelligence, with ignorance treated largely as a matter of corrigible bias or error on the part of lay thinkers.

The last 40 years, however, and especially the last two decades, have seen a flurry of new perspectives on uncertainty and ignorance whose magnitude arguably eclipses anything since the decade of 1660 which saw the emergence of modern probability theory. This activity has arisen in several fields at once, but most notably in those concerned with the interactions between people and modern complex technologies (e.g., economics, large-scale process and energy technologies, systems engineering, management science, computer science, and artificial intelligence). Many explanations could be adduced for this sudden upsurge in interest, and it may be too early to decide in favor of one above all others. By way of introducing one of the central themes of this book, however, I should like to briefly allude to the more popular explanations here.

One obvious explanation appeals to such matters as the increases in complexity and sheer scale of the technologies and organizations developed since World War II and the widely acknowledged failures of deterministic, mechanical models to cope with the uncertainties arising in such systems. Whole new areas of professional expertise such as risk assessment and decision theory have appeared in response to demands for ways of coping with these new uncertainties. More recently technological aids have been combined with human expertise in the development of expert systems, whose commercial appeal is based partly on their alleged capacity to handle both high complexity and uncertainty.

The results of these developments have been as bewildering as they are intriguing. The past 20 years alone have seen several nonprobabilistic formalisms proposed for dealing with uncertainty, surprise, doubt, fuzziness, vagueness, and possibility.

Probability itself has undergone major shifts in emphasis and the Bayesian school has ascended from relative disreputability to a point whereby it effectively challenges the frequentist school for dominance. New theories and accounts of uncertainty have been forthcoming from cognitive psychology, decision theory, management science, the sociology of organizations, risk assessment, studies of disasters and accidents, and economics. Managers and government leaders have altered their methods for dealing with uncertainty, moving away from the traditional attempts to eliminate or ignore it. The signs point clearly toward the emergence of new normative and explanatory paradigms of uncertainty and ignorance in response to the increasing complexity and uncertainty of the artificial environment.

While this explanation is intuitively appealing, it fails to account for a substantial number of developments that emerged independently of immediate commercial or other practical utility. Furthermore, several current innovations were clearly foreshadowed by work earlier in this century, particularly in mathematics, physics, and philosophy. Even a cursory investigation into any of these fields reveals that they underwent crises of certainty spanning the latter part of the 19th and the first half of the 20th centuries, from which they have only recently begun to recover. These crises were marked not only by increasing specialization and fragmentation, but also a loss of consensus concerning fundamental criteria of truth. The end results were the relativization of truth and the recognition of sources of incorrigible uncertainty or ignorance.

Those earlier developments provide several clues for what may be happening now, not only by pointing to a connection between the short term pragmatic concerns with technical complexity and wider intellectual phenomena such as specialization and relativization, but also in the strategies utilized by those in the thrall of these crises. In the next chapter I will compare the aptly termed "loss of certainty" (Kline 1980) in pure mathematics with the recent activities in theories of uncertainty. These comparisons will, I believe, point towards an understanding of crucial aspects of the Western intellectual response to a uniquely Western creation: The ignorance explosion.

Before we can make these comparisons, however, we must have a set of reasonable terms and definitions by which uncertainty and ignorance may be discussed intelligibly. There are, after all, a number of pitfalls in commonsense and even scholarly frameworks for thinking about ignorance, and so the next section introduces some necessary conceptual machinery.

## **1.2 A Framework for Ignorance**

Both the prevailing normative and explanatory frameworks for knowledge tend to treat ignorance as either the absence or distortion of 'truth'. This position immediately poses a problem because it requires the assumption that in order to talk of ignorance we must have established criteria for absolute knowledge and epistemology. A related problem is that from an absolutist standpoint, it seems as though we must fully enumerate the field of 'nonknowledge' in order to exhaustively describe ignorance. Clearly, such a task leads to the usual self-referential paradoxes. It might seem that the commonsense distinction between 'objective' (real) and 'subjective' (perceived) ignorance could get us by. After all, this is the duality that occurs both in probability theory and several other modern formalisms for dealing with uncertainty. But this distinction merely corrals the problem into a smaller enclosure. We are still faced with the problem of defining what objective ignorance is.

Even in the sociology of knowledge, where knowledge is viewed as a social

construct, the tendency to fall into naive absolutism surfaces in a number of major theoretical perspectives. In an early (and rare) article on ignorance from a sociological point of view (Moore and Tumin 1949), the definition of ignorance as the absence or distortion of truth is advocated explicitly. Despite their unfounded dogmatism, at least the sociologists have discussed this problem and it is worth taking a lesson from them on how to evade it.

The most blatant version of sociological absolutism occurs in both the functionalist and Marxist concepts of ideology, which boils down to erroneous thought with some version of 'science' providing the template for correct thought (for an unsuccessful attempt by a modern Marxist theorist to extricate himself from this trap, see Althusser's 1976 *Essays in Self Criticism*). Somewhat more consistent sociologists have fallen into the 'fallacy of dual residentialism' (Dixon 1980), which arises from assuming that correct thought is possible only for certain social groups (usually intellectuals). By contrast, the more recent 'strong programme' in the sociology of knowledge does not assume that what passes for knowledge in a given group of people at a particular time is valid or invalid. Instead, the object of study is the social relations that give rise to the creation and maintenance of knowledge systems (for an early version of this position, see Berger and Luckmann 1967; for an articulation of the strong program itself, see Bloor 1976).

Only by bracketing questions of epistemology has the sociology of knowledge been able to make substantial progress, as is most evident in its subdiscipline, the sociology of science (cf. Mulkay 1979, Knorr-Cetina 1981, Whitley 1984). Once we decide that the study of what passes for scientific knowledge does not require that we pass judgments on the validity of such knowledge, then we are able to find out how scientists themselves come to agree on what is scientific truth. Precisely the same strategy may be applied to the study of ignorance. Ignorance is a social creation, like knowledge. Indeed, we cannot even talk about particular instances of ignorance without referring to the standpoint of some group or individual. Ignorance, like knowledge, is socially constructed and negotiated.

A working definition of ignorance, then, is this: "A is ignorant from B's viewpoint if A fails to agree with or show awareness of ideas which B defines as actually or potentially valid." This definition avoids the absolutist problem by placing the onus on B to define what she or he means by ignorance. It also permits self-attributed ignorance, since A and B may be the same person. Most importantly, it incorporates anything B thinks A could or should know (but doesn't) and anything which B thinks A must not know (and doesn't). B may be a perpetrator as well as an attributor of ignorance.

A single definition is insufficient, however, to send us on our way. A second major pitfall in conventional approaches to ignorance is to view it as unitary. Ignorance is multiple, and has distinct levels. Some such distinctions have been known for some time. For instance in his dialog with Meno, Socrates pointed out the difference between what he called "ignorance" and "error". The person in error believes he knows that he doesn't know, while the ignoramus is conscious of his lack of knowledge. I prefer to term the first conscious ignorance and the second meta-ignorance, since Socrates' terms do not correspond to modern usage (cf. Smithson 1985). It is noteworthy that even meta-ignorance requires some person's viewpoint to exist, and so also is a social construct.

A second distinction that often is made in ordinary discourse is between informational and epistemological ignorance. This distinction pertains to whether the ignoramus is in error about factual matters or, even having the facts at hand, does not

process them appropriately. This is a useful distinction if for no other reason than that it enables us to deal with 'erroneous' information separately from information processing.

The most important distinctions, however, are those which refer to different kinds of ignorance, rather than different levels or loci. Another commonsense distinction which arises in common language is between 'ignoring' and 'being ignorant'. The first is in active voice, and connotes overlooking or even deliberate inattention to something. Being ignorant of something, on the other hand, is in the passive voice and connotes distorted or incomplete knowledge. This duality is fundamental and therefore is an appropriate first branching point in a typology of ignorance. The act of ignoring is a declaration of irrelevance, which is the term I will use to refer to this kind of ignorance. The state of ignorance, on the other hand, is in one way or another an erroneous cognitive state, and I will refer to it by the term error.

Language often reflects social reality, and there is more at stake than the difference between a transitive and intransitive expression. These two kinds of ignorance denote negative and positive strategies for dealing with anomalies and other threats to established cognitive order. The negative way is to ignore them or not perceive them, thereby in effect declaring the anomalies irrelevant and banishing them from reality. The positive way is to revise the framework of reality itself to make a place for the anomalous material, even if only within a declaration of ignorance. The former is a strategy that results in exclusion; the latter ends in inclusion.

Error may arise from either incomplete or distorted views (or both, of course). Distortion usually is referred to in terms of 'bias' or 'inaccuracy', on the one hand, and 'confusion' on the other. The former refers to distortion in degree while the latter indicates wrongful substitution in kind. Incompleteness, on the other hand, has received considerable attention from philosophers and other scholars, quite possibly because it seems more corrigible than distortion (readers should take care not to confuse this term with 'completeness' in the mathematical sense). As a consequence, it has been subdivided more minutely. For purposes of our discussion, I propose to dichotomize incompleteness in a similar fashion to the bicategorical division of distortion. Incompleteness in kind will be termed absence, while incompleteness in degree will be called uncertainty. Uncertainty, in turn, includes such concepts as probability, vagueness, and ambiguity. I will delay further dissection of this part of the typology for now, however.

Turning now to irrelevance, the most obvious kind is untopicality. For our purposes, it refers to the intuitions people carry with them and negotiate with others about how their cognitive domains fit together. Topical consistency is, for example, one of the unspoken rules guiding ordinary conversation. Folk-wisdom lauds geniuses for their avowed capacity to see connections between matters that appear irrelevant and unrelated to most people. However, a similar attribution is made about the insane. There are two other kinds of irrelevance that pertain to our typology: undecidability and taboo.

Undecidability is attributed to those matters which people are unable to designate true or false either because they consider the problem insoluble or because the question of validity or verifiability is not pertinent. Certain kinds of fantasy and fiction have this latter quality, as do thoughts that are considered nonsensical or meaningless. It could well be argued that undecidability has two senses, however, one of which belongs outside of the irrelevance domain. The relevant kind of undecidability, however, is to a large extent captured by terms such as 'uncertainty' or even 'incompleteness', and so I will not list it separately under error.

Taboo, on the other hand, is socially enforced irrelevance. Douglas (1973:100-101) was the first to systematically elaborate this point, and her discussion of taboo holds much of interest for anyone who would understand cultural responses to uncertainty. Taboo matters are literally what people must not know or even inquire about. Taboos function as guardians of purity and safety through socially sanctioned rules of (ir)relevance. This concept is particularly rich in its explanatory power for how we deal with anomalous or cognitively threatening material, and Douglas places her concerns with taboos in the center of any explanation concerning how we deal with disorder. As she points out (Douglas 1967: 39), any system for cognitively ordering the environment gives rise to anomalies, and all cultures must therefore confront these anomalies with appropriate strategic defenses. The sophisticated normative paradigms in Western intellectual culture of probability theory, decision theory, and their more recent counterparts and competitors are examples of such strategic defenses. All of them invoke taboos regarding the kinds of uncertainty or ignorance that are beyond the scope of scientific, logical, mathematical, or otherwise 'proper' analysis.

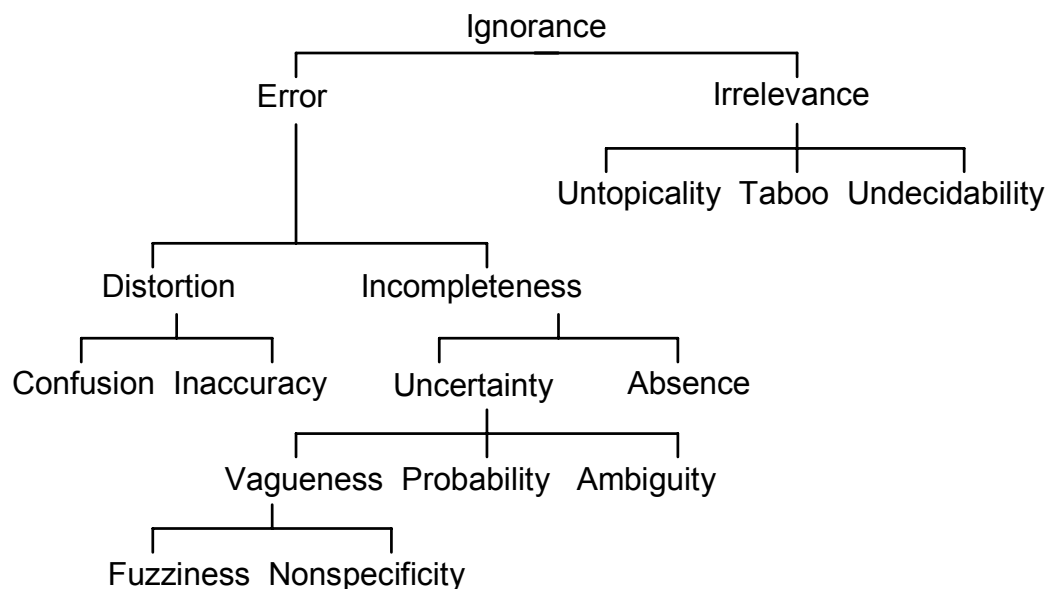


Figure 1.1. Taxonomy of Ignorance

The complete taxonomy is displayed in Figure 1.1. While some readers might wish to use different terms or make other distinctions than those I have provided, I should nevertheless like to argue that this is a viable framework. It is certainly better than the efforts we have reviewed thus far, and where possible adheres to standard usages in the philosophical literature.

Let us return briefly to the topic of uncertainty, which I have not discussed yet and which has been allocated a low position in the Figure 1.1 taxonomy despite its predominance in several fields. Uncertainty, as will become increasingly evident, occupies a special position as one of the most manageable kinds of ignorance. In some fields, the term is employed as a synonym for ignorance. It should be clear by now, however, that uncertainty is not as broad a concept, even though it is the home of probability theory and several other newer normative approaches to ignorance.

I have anticipated some of the arguments in this book by subdividing uncertainty into vagueness, probability, fuzziness, nonspecificity, and ambiguity. As I will argue in Chapter 4, these labels correspond with fairly widespread usages in both philosophical and scientific literature. This is not the only way to subdivide

uncertainty. However, most other taxonomies (e.g., Howell and Burnett 1978) are based on well known probabilistic concepts. Kahneman and Tversky (1982), in their article on variants of uncertainty, provide psychological and phenomenological arguments for dichotomizing uncertainty into that which is attributed to the external world and that attributed to our internal state of knowledge. This dichotomy resembles the objective/subjective duality that runs through the history of probability theory. The external variant of uncertainty in turn may be assessed from either a 'distributional' or 'singular' (case-wise) point of view. This division also has probabilistic overtones, resembling the distinctions often drawn between probabilities as relative frequencies in long runs of events and probabilities of unique events. Likewise, their division of internal uncertainty into 'experiential' and 'reasoned' modes echoes another theoretical division between the empirical and a priori schools of classical probability. The authors of course recognise the antecedents of their categories and do not claim great generality for their scheme. The purposes of this book require an approach to uncertainty that is not restricted to probability theory.

### 1.3 The Rest of this Book

The remainder of this book has a two-part format reflecting the schismatic structure of Western discourse on ignorance. One side of the schism consists of normative paradigms, while the other might be called descriptive or explanatory perspectives. Until quite recently the tendency has been for each side to be unfamiliar with the other, and one of the motivations for writing this book is to provide some bridging concepts and discussions. Applied scientists, statisticians, engineers, and computer scientists could benefit considerably by knowing more about what behavioral and social scientists say about how people perceive and respond to ignorance in its various forms. Likewise, behavioral and social scientists would have even more to contribute if they were more knowledgeable about the controversies over probability theory and the more recent emergence of nonprobabilistic formalisms for representing uncertainty.

Accordingly, I have tried to write each chapter at the level of the ever-elusive 'intelligent nonspecialist'. However, I rather doubt that I have succeeded, and so I wish to offer a map for guiding the reader through the maze of material that lies ahead. Chapters 2, 3, and 4 comprise Part I, which outlines the normative frameworks on ignorance. This material is likely to be more familiar to readers with a grounding in applied mathematics and statistics than those in the behavioral sciences. Part II includes Chapters 5, 6, and 7, and provides overviews of the accounts of ignorance that have come from psychology, sociology, and cognate disciplines. This material will, of course, be more familiar to behavioral scientists and less so to engineers and physical scientists or mathematicians.

Chapter 2 begins with an outline of the philosophical consequences of striking any 'middle ground' between strict dogmatism and radical skepticism, arguing that middle-ground positions necessarily complicate our view of ignorance. Therefore ignorance, for most of us, is multi-faceted and problematic. This theme is carried into a comparison between two professions that have long-standing traditions for coping with uncertainty: Engineering and law. The strategies and standards adopted in these professions are explicable in terms of the primary agendas and practical needs of their practitioners, and this finding suggests that recent ferment about ignorance and uncertainty in several fields may also be linked to social, political, or economic interests. What may be required by way of an explanation is an account of how practitioners and scientists have changed not only their strategies for dealing with

ignorance, but also their beliefs in such goals as the eradication of ignorance. Chapter 2 ends with an account of the crisis in pure mathematics at the end of the 19th Century, in which mathematicians were forced not only to abandon the quest for absolute certainty but also to alter their conceptions of mathematical ignorance and their strategies for coping with it.

Chapter 3 applies the framework suggested by the material on the crisis in mathematics to the controversies among competing schools of probability theory. Those readers familiar with the philosophical debates over probability may not find much that is new other than the viewpoint, while the material may strike others as somewhat abstract or technical. I would urge those in the human sciences, especially, to persist; there are riches here that can be mined for their research implications. This chapter is not the only attempt to present the competing schools of probability to nonmathematicians. In fact, I recommend Oakes' (1986) clear and lucid commentary on statistical inference as a complementary text for behavioral scientist readers.

Some of the most exciting recent developments in uncertainty are prescriptive theories that grew out of critiques of probability, and these are surveyed in Chapter 4. Unfortunately, there seems to be no other attempt to survey these developments in a nontechnical way, so for now readers are stuck with this one. I have endeavored to reach a readable compromise between comprehensiveness and depth. It is not possible for a single chapter to come close to either of those goals. Nonprobabilistic uncertainty formalisms have generated hundreds of publications per year for at least the past decade, and their level of technical sophistication has increased dramatically. Again, I can only urge readers who are unfamiliar with this material to persist, to treat this chapter as an introductory survey, and to follow up references on ideas that seem interesting.

Part II deals with the other side of the schism: Explanatory accounts of how we deal with ignorance. Chapter 5 examines the major trends in research emerging from psychology. The bulk of the psychological research on ignorance is grounded in probabilism, and that perspective therefore flavors most of this chapter. Some space is given, however, to the recent tentative moves by psychologists into nonprobabilistic uncertainty (e.g., fuzzy sets, ambiguity, and vagueness). The research results themselves as well as the debates over rationality and human intuition are instructive for knowledge engineers, expert systems designers, and artificial intelligence researchers. As with Chapter 4, Chapter 5 is a compromise between being thorough and covering topics in depth; the psychological literature in this area is voluminous.

Chapter 6 presents insights from certain branches of sociology, social psychology, and social anthropology. These disciplines have treated ignorance only marginally, but they offer points of view that differ widely from those in psychology. The starting-point for sociologists and social anthropologists is that ignorance and knowledge are social products, and the debates in their classics anticipate many of the modern arguments over rationality and realism in other fields. This chapter selects accounts of ignorance in the social order from the social science literature, primarily from micro-sociology and anthropology, the sociology of organizations, and the sociology of knowledge and science.

The perspectives described in Chapters 5 and 6 are younger than their normative counterparts, and in some cases do not amount to theories at all, let alone paradigms. Nevertheless, they contain ideas and insights that are crucial for approaching a complete understanding of where we are and where we are headed in our attempts to cope with uncertainty in particular and ignorance generally. Specifically, they may enable us to comprehend the nature of the paradigmatic shift that becomes apparent in



the material from Part I. Chapter 7 outlines some possible explanations for that shift and anticipates some future directions in the dialog between normative and explanatory accounts of ignorance. The competing normative frameworks, it is suggested, may serve different social or psychological functions and goals, and the second section of this chapter attempts to outline those functions as well as the tradeoffs involved in selecting one representation of ignorance over another. The chapter includes an example of a dialog between normative and explanatory frameworks in the setting of research on second-order uncertainty, which in turn points toward some fundamental dilemmas in deciding how to represent this kind of uncertainty.