

# Ignorance and Surprise

Science, Society, and Ecological Design

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# 1 Introduction: Brave the Unknown

Ignorance and surprise belong together. Surprises can make people aware of their own ignorance. A surprise is normally rendered surprising when it occurs unexpectedly and also runs counter to accepted knowledge. A surprise thus cannot be fully understood independently of a person's or a group's ignorance. In fact, novel things always include elements of surprise, uncertainty, and the unknown, all of which are located outside the sphere of prediction. Consequently, surprising events in research are often something to which scientists aspire in their activities since it means a window to new and unexpected knowledge. Scientific methods thus should allow researchers to surprise themselves as well as their peers. What is needed for doing so is an interruption of the continuum between accepted knowledge and future expectations. This interruption can be deemed an important foundation on which new findings are based. However, as Ludwik Fleck observed in 1935, "every new finding raises at least *one* new problem: namely an investigation of what has just been found" (1979, 51). New knowledge, in turn, allows for new options without delivering secure criteria for how these new options need to be handled.

The contemporary explosion of knowledge or the observation that our current age is the beginning of a knowledge society thus has a little remarked on corollary: new knowledge also means more ignorance. Thus, surprising events will occur more frequently and become more and more likely. If this is the case, handling ignorance and surprise becomes one of the distinctive features of decision making in contemporary society. The challenge in dealing with surprises lies in the fact that they lie beyond the spheres of probability and risk. This book examines the social prerequisites for surprises, the possibilities of their success, and their conceptual frameworks to better understand the handling of the "startling unexpectedness"

that is inherent in all processes of innovation, change, and invention. To illuminate these larger theoretical arguments, the book scrutinizes the surprising effects that are fostered by human interventions into the environment and the way that surprises can be handled in the process of designing landscapes and the restoration of brownfields.

### **Landscapes, Precaution, and Experiment**

Why use landscape design and ecological restoration as a touchstone? All over the world, regions exist where human activities have led to vast changes in the landscape—via industrial, military, and mining operations; urbanization and deurbanization; and the conversion of agricultural land or land for leisure activities. These human-made interventions have often triggered highly dynamic processes in landscapes and ecosystems and repercussions in society. To revitalize industrially altered landscapes, both policymakers and scientists frequently communicate that decisions have to be based on reliable scientific knowledge that should be free of uncertainty. Public debate on the limits of knowledge is often avoided on the assumption that it would undermine the public's confidence in scientific results. Therefore, both ignorance and its material consequences are usually externalized, and only known and observable "facts" are represented in policy and risk-assessment considerations. Ignorance thus becomes an "outlier" or a "black swan," to use Nassim Taleb's (2007) term, because it lies outside of regular and quantifiable events.

Not everything can be known, and absolute certainty is impossible—an inevitability that, as Weick and Sutcliffe (2007, 30) have noted, has culminated in "the hollow maxim 'Expect the unexpected.'" Furthermore, in everyday life most people know that many things happen to them unpredictably, but there still "is no conceptual language for discussing this thing that everyone knows," as Howard Becker (1994, 185) observed. Even so, when it comes to making decisions based on science and technology and communicating them to the public, undisputed scientific evidence with no side effects is demanded. Contrary to popular belief, there has never been a general belief in absolute truth and certainty among modern scientists and technologists (Moore 2008). The idea of certainty and truth through science, however, appears to be very much alive in official rhetoric. As researchers on modeling in global climate change (e.g., Shackley

and Wynne 1996; Lahsen 2005) have shown, scientists often talk about uncertainty but use a rhetoric that suggests that this does not imply a serious challenge to the authority of science. Instead, it appears that certainty must be rooted in the rhetoric of scientific knowledge, whereas uncertainty and unpredictability indicates the presence of other or “non-scientific” sources.

To reassure a supposedly risk- and uncertainty-averse public, emphasis has usually been placed on further research on known uncertainties to create greater certainty and supposed reassurance that the risks at stake will be controlled. *Uncertainty* normally refers to a situation in which, given current knowledge, there are multiple possible future outcomes. To reduce uncertainty in planning and implementation, the traditional belief is that proper scientific results will almost automatically lead to policy and implementation. This linear idea has also been called the “cascade of uncertainty.” Using the example of prediction in climate change, Steve Rayner (2000, 272–273) has argued that uncertainties in the science of basic earth-system processes are the basis for more uncertainties over emissions. This makes anticipation of impacts more difficult, which is followed by uncertainty about how groups of peoples will respond to such uncertain impacts. For many observers, cascading uncertainties appear to be a major hindrance to sound policymaking, and this cascade of uncertainty has led to a wait-and-see approach as well as a wait-until-more-science-is-available approach to climate policy. Thus, the funding priorities normally shift to the basic earth sciences to deliver knowledge that is more reliable. Instead of accepting uncertainty as a fact and then placing more emphasis on the possibilities of acting in spite of uncertainties, the least research effort is put into the social sciences and disciplines dealing with social and policy issues to absorb or effectively react to what cannot be avoided anyway. After all, coping with uncertainties and surprises is fundamentally different from predicting and preventing them. The challenge is how to knowingly and, increasingly, also publicly deal with what is not known without losing one’s credibility or “scientific authority.”

Some authors claim that the “precautionary principle” is aimed at cases where risks are poorly understood (see, e.g., Myers and Raffensperger 2005; Whiteside 2006). Originally, the precautionary principle was developed in reaction to the dominant regulatory standard, which requires affirmative evidence of harm before regulatory action can be taken. It was intended

to promote government regulation of risky industrial processes by shifting the burden of proof from the proponents to their opponents (cf. Halfon 2007; O’Riordan and Cameron 1995). In practice, however, the precautionary principle has often been invoked to prevent government action in contexts of scientific uncertainty. It has often been interpreted as a call to delay action until more research becomes available—to wait until certainty about the absence of harm is proven and until preventive actions in face of uncertainties can be taken. Moreover, as Freudenburg, Gramling, and Davidson (2008, 23) explain, even if the precautionary principle were to be understood “as stating that scientific uncertainty should not be used as a basis for inaction . . . such a formulation does not spell out what *should* be taken as an appropriate basis for action.” Precaution suggests what should not be done, not what should be done. Critics of the precautionary principle thus claim that it is contradictory and, if taken seriously, will block desirable changes and stop us from adopting better technologies. Cass Sunstein, perhaps the best-known critic of the precautionary principle, claims that the principle “purports to give guidance, but fails to do so, because it condemns the very steps it requires” (Sunstein 2005, 14).

I believe that both interpretations—the one that claims that precaution means paralysis and the one that says that precaution must be a key feature in regulatory politics—have not dealt seriously with the importance of ignorance and surprise. The critics ascribe a “better safe than sorry” attitude to the precautionary principle and recommend turning back to cost-and-benefit analyses and risk assessments based on known facts, thus ignoring the inevitability of uncertainty and ignorance. Proponents of the precautionary principle have not yet delivered any effective strategies for determining what exactly is to be done when decisions have to be made promptly and risk assessments or computer models cannot help in any meaningful way.

By way of building on these two opposing positions, an experimental approach will be developed in this book by reconstructing possibilities for acting in the face of (well defined) ignorance and outlining the necessary social and ecological capacities to cope with surprising events. The idea of experiment (from the Latin: *experiri*, “to try”) will be of pivotal importance to link ignorance and surprise conceptually and to learn from and cope with the unexpected. The idea of an experiment as a trial or a venture into the unknown is a crucial momentum of any scientific enterprise, albeit

experiments in the laboratory are characterized by detailed minutes and controlled procedures. Viewing ecological design processes outside the laboratory as experiments challenges premises of ecological predictability and certainty. After all, “experimentation is an effective strategy for sensing surprise” (Lee 1993, 58). Hans-Jörg Rheinberger (1997) has argued that what makes the physical, technical, and procedural basis for an experiment work is that it is deliberately arranged to generate surprises. Indeed, surprising effects of experiments can be seen as the motor force for producing new knowledge since surprises help scientists become aware of their own ignorance. Surprises are the impulse for unexpected knowledge. Put another way, similar to experiments in the laboratory, experimental activities in the real world can also bring surprises—but unlike in the laboratory they are often not welcomed.

In the following, a *surprising event* is understood as an occurrence that triggers awareness of one’s own ignorance. It will be seen as a prerequisite to becoming knowledgeable about one’s own ignorance (here called *non-knowledge*) as a basis for acting in the face of limited rationality and incomplete risk assessments. This calls for openness to surprises. Openness to surprises does not necessarily seek to prevent the occurrence of an event but accepts that the event will happen anyway. This approach becomes even more important if one acknowledges what ecologists have preached for a few decades—that there never was a balance of nature at any stage in its history and that to believe the contrary can at best be called romantic (cf. Botkin 1990; Pimm 1992; Krichler 2009). In other words, also from an ecological point of view, unexpected events can be called quite natural. Instead of waiting for the ultimate scientific truth about nature or a cost-benefit analysis about the risk involved in morphing the natural environment, a mindful openness to surprises can help turn unexpected events—including potentially threatening ones—into experimental practices or learning processes.

The challenge ahead is that new knowledge creates new options without delivering secure criteria for handling them. People may welcome the unexpected (since it creates opportunities for innovation), but they also seek to control, steer, or even reverse the surprising events. Understood this way, curiosity and the fostering of surprises enter a paradoxical relationship. They need to be both unleashed and controlled, if not at the same time then certainly in a well-organized and reflexive fashion. In this

way, this study is a contribution to current debates on reflexive modernity (Beck, Giddens, and Lash 1994; Lash 1999), on ecological modernization (Huber 2004; Mol 2001; Spaargaren, Mol, and Buttel 2000), and the many small-scale experimental initiatives towards more sustainable communities. After all, as Gill Seyfang (2009, 185) writes, we need “policy changes to allow these initiatives the space to experiment and fail, free from regulatory controls which hamper evolution of ideas.” In this way, the book is also a contribution to discussions on science and new forms of innovation in the knowledge society (Felt et al. 2007; Stehr 1994) and on science’s changing ways of knowledge making (Funtowicz and Ravetz 1990; Nowotny, Scott, and Gibbons 2001). At times, ecological modernization and transformation will require that environmental goals be emancipated from purely economic values and incentives, which is something that the proposed call for a preparedness for surprising events takes as a pivotal element in the development of successful decision making directed by ignorance. Debates about knowledge societies and reflexive modernization generally circle around an expectation that in the twenty-first-century world the widening and deepening of scientific mechanisms of social control (and thus the level of uncertainty in the world) will increase rather than decrease. Furthermore, many relevant empirical studies in the so-called new political sociology of science (cf. Frickel and Moore 2006)—such as studies on knowledge gaps (Frickel 2008) or undone science (Hess 2007)—make a standard call for a new vocabulary to sort out different types of ignorance. I hope to contribute to this call. In this book, I regularly look at some of the leading points of these streams of thought.

### **Objectives**

First, this book analyzes some classical and contemporary social science accounts of the role of ignorance and surprise in science and ecology and integrates them with the idea of experiment in society (chapters 2 and 3). In its second half, the book examines the role and importance of an accommodation to surprises and unintended turns in the dynamics of large-scale landscape change and restoration (chapters 4 and 5).

In chapter 2, the reader is introduced to ways that surprises can be theoretically framed as the driving force behind a notion of scientific activity and social life in general. Surprises give particular credit to the unsteerable



dynamics of the natural world that cannot be reduced to social, institutional, and cultural issues. To focus on surprising events, a shift away from the focus on the classical institutional preparedness is needed, so that unexpected (or natural) phenomena involved can be reconsidered. In other words, rather than finding explanations mostly in social capacities, the focus on the surprising (and in this sense, nonsocial) elements points to the ignorance of human actors about the behavior of the natural or complex technical world. In this chapter, discussions of a “surprises-laden” development of modern society range from the classical writings of Georg Simmel to current debates on new modes of knowledge production. These concepts are scrutinized (using the coevolution of restoration as a public practice and an academic discipline) to understand strategies for dealing with unexpected events. The Chicago school of sociology’s understanding of modern societies’ experimental development is used to help explain surprises outside of the laboratory as a crucial part of handling unexpected events. To illustrate the normalcy of different types of surprises as they are perceived by different actors, the chapter finishes with a discussion of an ecological restoration strategy that includes unexpected elements in landscape development—the return of wolves to eastern Germany.

Since surprises can be seen as a prerequisite for making people aware of their own ignorance, chapter 3 frames different types of unknowns (non-knowledge, ignorance, and the like) as they appear in science and everyday practices. Using Simmel’s perspective on nonknowledge (*Nichtwissen*) as a touchstone, the chapter develops a notion of how unexpected occurrences can be incorporated into an experimental model of scientific and technological development that includes the experimental handling of “surprises.” In contrast to the work of many other writers on subjects dealing with ignorance, I develop a model to provide an understanding of how different forms of unknowns can be conceptually connected and how in the analysis of social processes these different unknowns can be chronologically related to one another. The advantages of such a dynamic model over ever-new taxonomies of types of ignorance are critical to grasping the many shadings of the unknown. The example I use to illustrate the development and chaining of different unknowns is malaria control. The model of different unknowns can be integrated into a broader notion of experiment as a novel form of dealing with new forms of knowledge production that are problem-focused, context-driven, interdisciplinary, and perhaps

even transdisciplinary. By so doing, I draw on insights from adaptive management and intelligent trial and error but also go beyond these approaches by focusing on the experimental character and the (positive) tension uncovered by the awareness of ignorance triggered through a surprising occurrence.

Chapters 4 and 5 take up the concepts developed in chapters 2 and 3 to analyze in more detail how ignorance and surprise can successfully play themselves out in ecological design projects. They look at ways of dealing with surprises in unintended results in ecological restoration processes in urban contexts and large-scale landscape transformation in former industrial areas. In some areas of landscape design and ecological restoration, the acknowledgment of the unknown and the expectancy of surprising events are accepted as a normal and sometimes even welcomed part of decision-making processes. Thus, urban parks and postindustrial landscapes provide telling examples of the “normal complexity” of handling ignorance and surprise in everyday life that will most likely gain in importance in many environmental fields on a global scale. Chapter 4 takes up knowledge production in the field of restoration ecology and its shifting boundaries as a proper science. The significance of the unexpected is discussed with the example of the morphing of Chicago’s shoreline on Lake Michigan from the nineteenth century to the present time. Of central concern in this chapter is the appropriation of surprises so they can lead to robust design strategies. Restoration ecology in a knowledge society does not require simply more knowledge and new technologies. It is a type of knowledge production that is permeated with surprising turns, which unfold with the application of new knowledge. In this spirit, the design of new landscapes is neither a linear process of master planning nor a process of trial and error involving variation and selection but instead is a carefully coordinated process of dealing with unexpected turns via experimental practice.

In Chicago, robust strategies have been developed for dealing with more or less rapid changes, but chapter 5 deals with the revitalization of former surface brown coal-mining activities from the era of state socialism in eastern Germany. The major focus here is the landscape that is south of the city of Leipzig, one of the largest human-induced landscape changes in European history. Comparing the experimental and postnormal character of the design of the shores of Lincoln Park in Chicago with the design

of new lakes emerging on the southern edges of Leipzig is enlightening for several reasons. Both regions are characterized by mainly state-funded and -initiated projects to restore and revitalize former degraded or less user-friendly areas. In both cases, the landscape is being “restored” without a historical reference point. In Chicago, a restoration in the strict sense would mean removing the landfill that since the 1860s has repeatedly pushed back the waters of Lake Michigan, and in Leipzig, it would mean returning the landscape to its appearance in the premining days from the same era. However, a major focus in the Leipzig case is on a reverse effect compared to the Chicago case. In Leipzig, early signs of success have become increasingly fragile due to lack of openness to surprises and acknowledgment of ignorance—that is, the transformation of ignorance into nonknowledge.

Finally, chapter 6 summarizes the book’s main arguments but also assesses experimental practices in a broader debate on the contingency and reflexivity of current modernity. It links the overall argument of the book to recent debates on knowledge generation in what Ulrich Beck and others have called *second modernity*. In second modernity, human societies have begun to realize that not all risks can be controlled and that they must be coped with and incorporated into planning and development. Some of the challenges of implementing strategies that produce both scientifically reliable *and* socially accepted restoration and remediation processes are explored. Experimental practices as an accommodation toward robust research strategies are scrutinized to illustrate the benefits and limits of such an approach in contemporary knowledge societies. If we agree that surprises can be a good thing and yardsticks need to be developed over the course of experimentation, how can we avoid turning an experimental approach into a camouflage for failed projects?

A final word on terminology: I often use the term *ecological design* although the cases in this book deal with issues such as ecological restoration, the operation of earth-moving technologies, the recultivation of large landscapes, and the management of malaria. I hope that this term helps me avoid the heated debates on the proper definition of *ecological restoration* and its demarcations from other activities in the natural world. Consistent with current ideas in ecological restoration and related areas, the term *design* also points to a reversion to the attitude of traditional approaches to nature. It represents a step beyond the fatalism that is

implicit in much of mainstream environmentalism, which at the core merely calls for a minimization of all human impacts on the natural world. If we define *design*, as some authors do, “as the intentional shaping of matter, energy, and process to meet a perceived need or desire,” then design indeed is “a hinge that inevitably connects culture and nature through exchanges of materials, flows of energy, and choices of land use” (van der Ryn and Cowan 1996, 8). Understood this way, architects, concerned citizens, engineers, environmental scientists, and landscape architects are all designers. Design is not bound to a particular profession. *Ecological design* thus can be defined as any form of human intervention with the natural environment that attempts to improve natural conditions or reverse environmentally destructive impacts.

Given the increase in this kind of design activities, the surprising outcomes that emerge from these activities increasingly define the world in which we live. The question now arises how surprises and the not yet known can be incorporated into our theorizing about modern society. I hope that this book is a first step in that direction.