Scientific uncertainty: how do we know when to communicate research findings to the public?

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Abstract

The problem of when to communicate research findings with the public arises with respect to a broad range of environmental and health hazards. What many people would like is a rule of the form, 'Communicate research findings if and only if condition C obtains.', where condition C reflects some function that includes the probability of a harm occurring, the seriousness of the harm, the reliability of the data on which these estimates are based, and the potential usefulness of these projections for mitigating or preventing the harm in question. I argue that no such rule is forthcoming. I go on to distinguish uncertainty from ignorance and indeterminism. Uncertainty is not an objective quantity but is socially constructed by context, rhetorical role, the assumption of purposes, and the acceptance of knowledge claims. In a particular case, the first step in deciding whether to communicate research findings to the public is appreciating how the uncertainties have been constructed. Only then can we go on to ask the ethical questions about communicating research in an illuminating way.

Keywords: Environmental epidemiology; Scientific uncertainty; Health hazards; Public, communicating research findings to; Ethics guidelines

1. Introduction

The problem of when to communicate research findings with the public arises with respect to a broad range of environmental and health hazards: earthquakes, radon, meat consumption, global warming, and biodiversity loss to name just a few. Often scientists feel as though they must steer between two extremes: a warning that is issued too early on the basis of weak data may scare people and discredit science; a warning that is issued too late may be useless for preventing a problem or mitigating its effects.

What many people would like is a rule of the form, 'Communicate research findings if and only if condition C obtains'. Condition C may reflect some function that includes at least the following elements: the probability of the harm occurring, the seriousness of the harm, the reliability of the data on which these estimates are based, and the potential usefulness of these projections for mitigating or preventing the harm in question. From this perspective, what is wanted is some N that is a value of the function in question such that C obtains if and only if the value of the function is N or greater. When C obtains scientists should communicate their research findings; when C does not obtain they should not.

This is a neat way of looking at the problem. It may be difficult to find the correct value for N and
to state C precisely, but conceptually the exercise appears to be straightforward. It holds out the promise of resolving ambiguity about when scientists should communicate their research findings.

2. Agreeing to disagree: clarifying terms

I believe that this tempting approach is misguided in virtually all respects. No N that could be produced would be believable. As Aristotle pointed out, one way of going wrong is to provide a precise answer to a question that does not admit of a precise answer. There may be clear cases in which a scientist should or should not communicate research findings to the public, but there are bound to be many unclear cases as well. Most of us would reject the idea that a condition could be formulated that would allow a clear line to be drawn between cases in which scientists should communicate risks to the public and cases in which they should not. Even if people would agree to a particular condition, they would still disagree about whether the condition is satisfied in particular cases, and ultimately about the elements of the function that inform the condition. Rather than disagreeing about whether to communicate research findings, people would instead disagree about the probability of harm, its seriousness, and the reliability of the data.

That a particular approach will not put an end to all disputes is not in itself a serious objection. Often a condition or function may be valuable as a way of organizing discussion. It focuses the discussants on the relevant considerations. However, the problem with the approach under discussion is that in not providing clear answers, it fails in its own terms, and by conceptualizing uncertainty as an objective quantity, it leads us away from important issues that require discussion. This can be seen by considering the fact that virtually every key expression involved is problematical. For example, it is far from clear what it means to communicate research findings to the public. Papers published in the open literature are certainly available for public inspection, and scientists often provide advice to government agencies. It is not clear whether these activities count as communicating research findings to the public. Scientists are sometimes asked to give interviews and sometimes they seek out the press in order to try to break a story. Are these equally cases of scientists communicating with the public? Does communicating with the public require writing articles for popular magazines, appearing on talk radio shows, and passing out leaflets in public places? Even these activities do not guarantee that the public will take notice. People can try to communicate, but can fail.

What counts as communicating research findings to the public depends on context and situation. Even when context and situation are fixed, there will still be cases in which reasonable people will disagree about whether research findings have been communicated to the public. For these reasons a general account of what is involved in communicating with the public is unlikely to be helpful in all cases.

3. Challenging the notion of uncertainty

These problems concerning the concept of communication are small relative to those regarding the following notion of uncertainty. On this notion, uncertainty is treated as a fixed quantity of which there is more or less. When uncertainty is involved, science is the agent whose job it is to reduce it. On this view, when uncertainty has been reduced sufficiently (whatever that means), research findings should be communicated. The social world is reduced to a passive public waiting for scientists to deliver their findings.

I challenge this notion of uncertainty. Uncertainty is not a fixed quantity and it is not always reduced by scientific research. Whether we have uncertainty and how much we have is relative to purposes, conventions, and context. The social world is active in the construction and characterization of uncertainty.

The general point can be seen from an everyday example. I discuss selling my car to a friend. In this context there is no uncertainty about whether I own the car. We both take it as given that this is the case. Of course it may be that due to fraud or forgetfulness I do not own the car. But in our discussion these possibilities are not on the table, and so there is no uncertainty about whether I own
the car even though it may turn out that I do not. Now imagine a situation in which we are highly suspicious of each other: it is well-known that I was once convicted of selling other people’s cars, or I suffer from amnesia. When the context is changed in one of these ways the problem of uncertainty may arise. My friend may demand proof that I really own the car before he will continue the discussion with me. What this homely example shows is that while we can always be wrong about (most) things, uncertainty requires particular contexts and social conditions.

Indeed, this very example has implications for uncertainty in the area of health and the environment. Uncertainty disappears or is minimized when we have complete trust in the person or data that is being interrogated. It is magnified or accented when there is mistrust, whether founded on fraud or other failings.

4. Uncertainty in the context of ignorance

Uncertainty is often conflated (i.e. confused) with ignorance and indeterminacy [1]. Consider first the contrast with ignorance. When we say that we are uncertain of something, it suggests that we know what it would take for us to become certain. When we are ignorant, on the other hand, we may not have a clue about how it can be overcome. Ignorance relates to the fact that we could be wrong about virtually any proposition to which we give our assent. In many cases, although we know that it is possible that we are wrong, we are not in a position to assess the probability of this being the case. If we had a better fix on the probabilities, we might be on the way to transforming ignorance into uncertainty. While uncertainty may pose a scientific problem, ignorance is virtually a metaphysical condition.

Still, ignorance lurks in the background of scientific knowledge claims. It moves to the foreground when new evidence comes flooding in that suggests that our previous views about some matter were not just wrong, but deeply and profoundly wrong. The discovery of the ozone hole, which was not predicted by any of the atmospheric models, is one example. So was the recognition of the chronic toxicity of DDT, which also came as a surprise [2]. Ignorance looms large with respect to many health and environmental risks. In some cases we may know that various exposures are associated with harms, but have little idea of what causal mechanisms are at work. Although the statistical evidence may be strong enough for some to attribute causality, even in these cases we may suffer from ignorance. Our view of the matter may simply be wrong — not in details, but thoroughly so. Furthermore, we may have no way of assessing the probability of our being so deeply misguided. The fact of ignorance is usually — indeed often must be — ignored, but it always presents the possibility of bringing down an entire edifice of knowledge.

Uncertainty arises from ignoring ignorance. We take various features of a problem as given and focus on other dimensions. For example, it is widely agreed that the case for climate change is weakened by the fact that we are uncertain about the effects of clouds on the climate system. The solution is for more intensive study of cloud formation and effects. But to identify clouds as an area of uncertainty is already to presuppose that our general knowledge of the climate system is not uncertain, that the climate models are basically correct, and so on. This background knowledge is ‘black boxed’ — it is taken as a set of assumptions from which we proceed to try to reduce uncertainty. This approach of taking some propositions as fixed while interrogating others is a fundamental part of scientific practice. Scientific progress would be impossible if every proposition were ‘problematized’ in every investigation. However it is important to recognize that the ‘black boxing’ of particular propositions can be a broad cultural process as well as a narrow scientific one.

5. Uncertainty in the context of indeterminacy

Uncertainty should also be distinguished from indeterminacy. Often what appears to be uncertainty cannot be reduced because there is no reliable fact of the matter to be learned that bears directly on the uncertainty. At least two sources of indeterminism can be identified: human agency, and underdetermination.

Many of the most serious environmental and
health problems we face involve agency. Part of why we do not know what will happen to global climate in the twenty-first century is because we do not know how people will behave in the future. Will they continue to increase their use of fossil fuels? Or, will other energy sources be substituted? Will governments undertake policies to geoengineer climate [3]? Will there be other responses to early signs of global warming? These are just a few of the questions whose answers matter in determining what will happen to future climate. Similar questions could be raised about the effects of tobacco smoke, the prevalence of HIV, and so on.

The indeterminism that results from agency is made worse by the fact that predictions about human behavior can themselves change the behavior that is being predicted [4]. Consider a simple case. At 8 am on a warm summer day the local radio station predicts that there will be massive traffic jams as thousands of people flock to the beach. The traffic jam fails to materialize. Many people heard the radio broadcast and decided to stay home.

A second source of indeterminism flows from the underdetermination of theory by data [5]. Any piece of data is evidence for a multiplicity of distinct hypotheses. This is why different people with varying world views can feel vindicated by one and the same experience. A classic (although perhaps apocryphal) example concerns the seventeenth century philosopher Malebranche. While explaining to an interlocutor (i.e. a discussant) his view that animals are cleverly constructed automata, he came upon a pregnant sheep. He kicked the sheep as hard as he could in the stomach and the creature ran off into the woods bleating. ‘You see,’ said Malebranche, ‘what cleverly constructed automata they are — you would have almost thought that she was in pain.’ Malebranche was assuming that sheep are automata, and the observation was taken to bear on the question of whether they are cleverly constructed automata. But of course another person might have taken this observation as evidence against the view that sheep are automata in the first place, whether cleverly constructed or not.

6. Uncertainty as an epistemological construct

What I have been suggesting is that to regard some proposition as uncertain is already to make some very large assumptions. In order to do this, various problems about ignorance and indeterminacy must be pushed aside. Large social forces as well as small scientific ones can be involved in this pushing aside. Uncertainty, rather than being an objective quantity that is invariably reduced by intensive scientific research, is epistemologically constructed. That is part of the reason why no plausible value N or condition C can be identified.

7. Uncertainty in relation to purpose

There are two further points that should be made. First, when we say that something is uncertain we are relating it to a purpose. This is very clear in debates over environmental policy. Some people claim that it is uncertain whether emitting greenhouse gases into the atmosphere will change climate; others seem to deny this. But in some cases they are not really disagreeing. Both parties to the dispute may agree that for the purposes of counting as scientific knowledge the proposition is uncertain. More research needs to be done, data collected, and so forth. But those who seem to deny that there is significant uncertainty are often claiming that while there is scientific uncertainty, there is no uncertainty for the purposes of public policy. We know that the risk of climate change is great enough, and the costs of mitigation and prevention are low enough, that some ‘no regrets’ strategies ought to be pursued. This is an example of a case in which it is clear that the scientific data may rightfully be regarded as uncertain for some purposes but not for others.

8. The rhetorical role of uncertainty claims

We should further recognize the rhetorical role of uncertainty claims. Often, because of how public debate about environmental issues is constructed, invoking scientific uncertainty is a way of implying that no action should be taken. Those who want to take action then feel compelled to
deny that there is uncertainty. In my view, it would be far better if we could conduct our debates about environmental and health policy in the language of values [6]. Often these debates really are about values and can be more meaningfully discussed in that vocabulary. The scientific rhetoric is often just code for the real views of the participants.

9. Conclusion

I have argued that no moral algorithm is forthcoming for when to communicate research findings to the public. Some may think that this is equivalent to asserting that there is no right or wrong in this matter. But that would be mistaken. The kinds of issues that I have raised in this paper are highly relevant to answering particular questions in particular cases. When someone claims that the science is uncertain in a particular case, the first step is to understand what that claim implies in its rhetorical context. What is the unspoken background against which this claim is made? For what purposes is the science regarded as uncertain? Raising these questions will not immediately tell a scientist what to do in a particular case, but it is the beginning of understanding what is at stake, why, and for whose benefit. These are the considerations that should figure centrally in any decision to ‘go public,’ and recognizing them is the beginning of serious ethical reflection. From here we can go on to ask questions about possible outcomes, intentions, rules, and character. But to ask these questions prematurely is to provide only phantom ethical guidance that may make matters worse rather than better.

References