# What's Uncertainty Got to Do with It?

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Research is all about turning what we don't understand into what we do understand. Yet there are limits to the ability of science or any discipline to understand the phenomena they study. This means that policymakers need to make decisions without being entirely certain that their analyses are complete and correct. That is, uncertainty is baked into the decisions that stakeholders need, policymakers must make, and researchers shed light on. How that uncertainty is handled can make a very large difference in the decisions we make, and whether these decisions are truly useful.

This document explains the notion of uncertainty, some pitfalls in handling it, and how it is handled in the Equitable Pathways Method, the decision support tool at the center of the Baltimore Social-Environmental Collaborative (BSEC), which is led by Decision Scientists.

**What's Uncertainty?**

Uncertainty is any aspect of a phenomenon that is random or that is not fully understood. It shows up when we look at issues we face right now (will a tossed coin come up heads or tails?), but it really starts to bloom when we ask questions about the future (how should I eat now to feel best at age 70?) or when there are many factors at play (why did a financial crisis happen?).

Even when there's a lot of uncertainty in an issue, there are often elements we are confident about. For example, it is certain that excess carbon dioxide, methane, and other gasses in the atmosphere are changing the climate. It is certain that these changes stem from human behavior. It is uncertain exactly how the climate will change in specific places. Or how living beings will adjust.

How confident do we need to be in the specifics of a situation before a decision should be made about it? That's a matter of judgment. In some situations, more research can be done soon enough that it makes sense to hold off on choosing an action. In other situations, we face an immediate situation and need to choose as wisely as possible right now. Those who benefit from the status quo can use uncertainty to impede action, as has been the case with climate change since at least the 1980s.

**Uncertainty and Our Brains**

People aren't very good at looking uncertainty in the face. That's just being human – we don't have enough brain power to process all the information available to us through our senses, let alone through scholarship. To quote Psychology Today, "We humans don't like uncertainty, which involves a sense of doubt, anxiety, fear, and insecurity." When we are uncertain, we often hesitate to make decisions. Human brains unconsciously pick and choose what to pay attention to so that we can move through our lives. We may also make decisions that reflect the

advice of people we rely on, social pressures, our values and what we like, or what seems doable at the moment a decision is needed. All of these are ways of sidestepping uncertainty. This works well for everyday decisions, but often falls short in situations that are more complicated, involve a long period, or where multiple perspectives need to be considered. And it is irresponsible when decisions will affect many people's lives.

A key role of the Decision Scientists in BSEC is to help people address uncertainty in decisions made on behalf of many people. Decision scientists focus on two situations:

- **Where people overlook or underestimate uncertainty, so that decisions are based on representations that are too simple.** It is often tempting to plan for the most likely future, as traditional methods often do. A danger of this approach is that we might fail to prepare for extreme cases, such as severe rains over Ellicott City and West Baltimore that are unlikely but could be catastrophic.
- **Where people try to take in all the uncertainty, they may be paralyzed.** Decision scientists create tools that help people move through such decisions.

**Where Does Uncertainty Creep In?**

There are three primary sources of uncertainty:

- It is impossible to measure anything with total accuracy.
- What is being measured may vary a lot, so the results from measuring any sample do not reflect the actual range of values. This applies to random phenomena, like rolling dice.
- The situation has been oversimplified. For many phenomena and problems, researchers create a model of the object of study, and then work with that. Examples range from studying bacteria in a petri dish rather than in the plant it typically lives on, to a computer model of what happens during a stock market panic. Researchers do their best to specify how the model differs from the real world. Still, their conclusions may be more applicable to the model than to the real-world phenomenon.

Oversimplification is often what's most troubling for decisions that will have large effects on people and the planet. (See the Explainer on Complexity for more on this.) Here are some ways in which we end up with oversimplified models, and how this can make it challenging to identify climate change adaptation strategies that advance equity:

- Climate change is generally studied at the global scale. Specific impacts at the city scale are harder to quantify or predict. A key goal of BSEC is to reduce uncertainty about what climate change means right here in Baltimore.
- When experts define problems without sufficient input from stakeholders, they may miss important aspects of the problem. If BSEC wants to produce equitable outcomes, it needs to understand equity from the perspective of underserved neighborhoods.
- When the problem is truly complex – such as dismantling racism, stopping climate change, or peace in the Middle East. These are problems that simply cannot be modeled accurately. The behavior of the system becomes unpredictable due to unexpected effects of different variables. And even if it were possible in theory to pin it all down,

different stakeholders would disagree on the central issue. This is why BSEC emphasizes stakeholder engagement and a multidisciplinary approach.

**What Changes When We Consider Uncertainty?**

Uncertainty is incorporated in two ways into the Equitable Pathways Model, the decision support tool at the heart of BSEC. First, information about what is *known* about uncertainty is input into the model. Examples include a variety of projections of emissions, demographic change, changes to the climate, etc. In essence, we feed the model information that is combined to create many possible futures. Second, the researchers acknowledge the areas of uncertainty they cannot quantify, and use this in evaluating the outputs of the Equitable Pathways Model.

How is this useful rather than simply exhausting? How does it make plans and decisions wiser? Clarity about uncertainty can give us humility and flexibility, so that we can commit to a course of action today, be prepared to incorporate new evidence that supports adjusting the original plan, and have triggers that prompt us to assess whether a course correction is right. That is, we learn to favor continued learning.

Here are some specific ways that understanding uncertainty in a situation can help:

- When we know there is uncertainty about a specific phenomenon, we can do more research and plan to incorporate the findings down the road.
- When we know our model is incomplete we can continue to listen to disparate perspectives.
- When we recognize uncertainty, we can create mechanisms to prompt us to reflect on what we got right and wrong and then adapt our course of action.