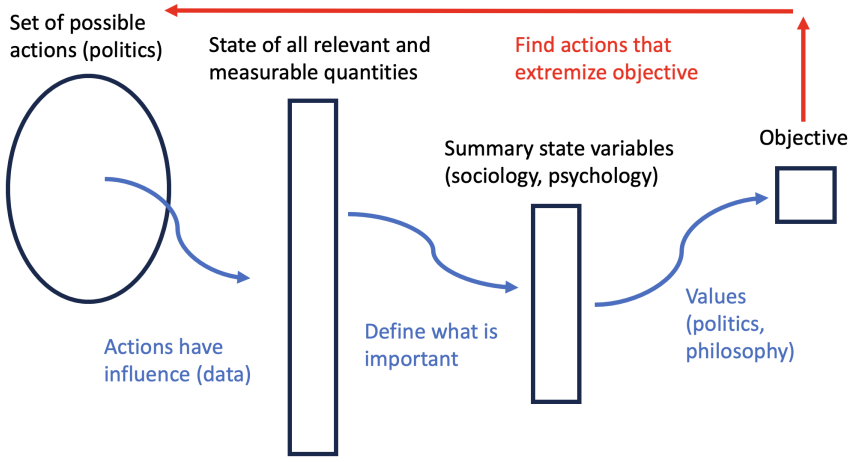
Knowable Problems

When we talk about ethical dilemmas and social problems, such as climate change or digital technology's negative effects on mental health, it is typical to first explain the problem, then talk about possible solutions. But for really nasty problems, proposed solutions often don't seem very actionable or realistic. It is unfortunate that realistic solutions are frequently ineffective, and effective solutions unrealistic. In response to this apparent bind, I propose the following: we should not pretend like we know what to do, but rather, *we should invest effort in building a strong understanding of why the problem is hard.* The nature of a problem's difficulty can be known without having a solution to it. I call this paradigm "knowable problems." In fact, characterizing why something is difficult is often quite easy! Scientists and engineers are already comfortable with this way of thinking–for example, we say that nonlinear models are more complex and unpredictable than their linear counterparts. Furthermore, high-dimensional problems are typically harder because of the "curse of dimensionality." Linearity and problem dimension are properties which are simple to investigate. Thus, we can determine *why* a problem is hard without having any solution to it. What if we brought this kind of thought into complex social and political problems?

It may seem counterproductive to de-emphasize solutions, but I am not convinced that a hard problem can be solved without first being deeply understood. I suspect that the conceptual tools of physics and mathematics can provide guidance in mapping the contours of the difficulty of a "wicked" problem. Let me be clear–I do not think that we can model everything in the world mathematically. I am not a guileless techno-optimist or solutionist. Rather, what I argue is that mathematical thought can help us under the essence/structure of hard problems. If we think of metaphor as a tool of abstraction which takes something complex and unfamiliar and represents only its essential bits in terms of the familiar (as is often the case with stories), we might say that mathematical models can be used as a kind of metaphor to grapple with complexity. We learn something qualitative by attempting (and probably struggling) to fit complexity into quantitative models. This is a very weird kind of metaphor!



In the attached figure, I represent political decision making as an optimization problem. Specific actions are made possible by the political structure of society. These actions influence all aspects of society, whose state is summarized in terms of a reduced set of statistical metrics. This summary state is mapped to an objective by values. This framework helps illustrate the following: decision making is hard because the relationship between facts and states is probably impossible to conclusively determine. Similarly, states are vaguely defined, and what we pay attention to (median income vs. something subjective like happiness) is arbitrary and cultural. Furthermore, the relationship between a state and the objective is driven by values, which of course have no hope of being universal.

I think that understanding the nature of a problem's difficulty represents a meaningful advancement in ethical awareness, and this entails a confrontation with the complexity of the real world. The partial differential equations of solid and fluid mechanics are seductive in their power to tame the complexity of phenomena like fracture and turbulence, but all evidence suggests that the physics of continua are simple compared to the complexity of systems involving interacting agents. From what I can tell, realistic agent-based systems differ from mechanics in their resistance to formulation in terms of a set of simple laws. Like other humans throughout history, when confronted with complexity that is overwhelming, I am inclined to tell stories about it. Stories are quite powerful for distilling and dramatizing the relevant features of a complex problem. For me, the stories I want to tell are mathematical–and maybe by borrowing some of math's tools, we can deepen our understanding of why certain problems are, well, insanely hard. Though this may not yield immediate answers for solutions, I see it as a definitive step in the right direction.