INTRODUCTION

The Future of Prediction

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Among all forms of mistake, prophecy is the most gratuitous.
— GEORGE ELIOT, MIDDLEMARCH

Everyone questions his memory, but no one questions his judgment.
— LA ROCHEFOUCAULD

The future just won’t stay still. We imagine we can predict it, that we can diminish or erase its uncertainty, and that we can mitigate the power of the radically unknown. Almost always, events prove us wrong. Then we forget these mistakes and go on making predictions with undiminished confidence.

As Barry Glassner observes in the present volume, predictions of disaster seem to exercise special attraction, as if the more critical the problems we face, the more significant are our lives.¹ Today, the media report a wealth of catastrophes. Oil may run out, but no one predicts the end of terrifying predictions: new microorganisms, produced naturally or in some laboratory, and circulating accidentally or by design, threaten the human race; the more nations that have nuclear weapons, the more possible nuclear war becomes. Will the Cuban missile crisis look quaint some day? The older nuclear technology gets, the easier it will become to acquire it. The rise of powers more dangerous, because less given to self-preservation, than the former Soviet Union makes the old strategy of deterrence look less and less viable. So does the rise of terrorists without a state to deter. Or so we are told.
The technology that improves our lives also threatens to destroy them. The more dependent we become on GMOs (genetically modified organisms), the more destructive a disease affecting them might prove. Recent violations of civil and political liberties by the NSA and IRS, as well as corporate spying, suggest the possibility of a new totalitarianism. In 1984, the ubiquitous “telescreens” destroyed privacy, but that image seemed like a paranoid fantasy on Orwell’s part. The cameras everywhere in London, government tracing of emails, and the use of computers to do analysis that only recently required human beings may soon make privacy as outmoded as monks copying manuscripts. And what if we are on the verge of reading people’s minds by brain scans?

Many kinds of environmental disaster threaten. We read more and more predictions about the effects of climate change, which give us a spectrum of catastrophes. The very actions we take to forestall a disaster may make it more likely (an example given is the use of ethanol) or create new ones. Some predictors take it for granted that we will run out of natural resources, since the supply of anything is by definition limited.

Even when a problem seems to be advancing gradually, it is possible to draw a curve showing rapid acceleration to come. No one ever raised money to solve a problem that wasn’t urgent. We may be at a “tipping point.” How can we tell?

Indeed, the very popularity of new terms like “tipping point” and “inflection point” testify to our recent attitude to the future. Even where things seem benign, they may be on the verge of horror. Right or wrong, many people still feel as if the present moment is especially urgent.

But might it not be that our view of the present is mistaken, the product of our temporal and temperamental egoism? Surely the 1930s and 1940s gave more reason for fearing the future than the present does. Is it possible to compare our attitude toward the future with that of earlier times? Every age has its “futuribles” (set of anticipated futures that could happen), so wouldn’t some sort of comparative futurology give us perspective on our own obsessions about what is to come?

In 1955, Fortune magazine marked its twenty-fifth anniversary by publishing The Fabulous Future: America in 1980, which brought together some of the smartest and most influential Americans to speculate on the world to come. Contributors included John von Neumann, who not only made important contributions to mathematics and physics but also
founded game theory and cybernetics; David Sarnoff, chairman of RCA, then synonymous with technological progress; Crawford Greenewalt, president of Du Pont; Adlai Stevenson, who was the Democratic candidate for president in 1952 and would be again in 1956; Chief Justice Earl Warren; AFL-CIO president George Meany; Treasury Secretary George Humphrey; Harvard president Nathan Pusey; and several others. Their contributions both reflected and shaped the wisdom of the times.

They weren’t entirely mistaken. As they guessed, the pace of technological change sped up, polio was conquered, and “calculating machines” were invented. But in detail and in broad conception they were almost comically off the mark. Von Neumann foresaw a world in which “energy would be free—just like the unmetered air.” Sarnoff deemed it indisputable that ships, aircraft, locomotives, and even automobiles would be atomic-powered. Houses and industrial plants would run on small atomic generators, and so coal, oil, and gas would be displaced as fuel. We would all commute in personal helicopters. Guided missiles would deliver intercontinental mail. We would have the capacity not only to predict the weather far in advance but also to change weather and climate. Naturally, we could foresee the effects of any such intervention.

Society would also improve. The workweek would continue to shorten. Soon we would be worrying not about how to create jobs but about how to spend all our leisure time. The economy would no longer be subject to serious recessions. Scientific discoveries would strengthen our faith in the Creator. War would cease to be an instrument of national policy, and as communication (especially television) improved, nations and individual people would understand one another better and grow less hostile. We would have a world police force.

Almost as remarkable is what was not foreseen. No one, not even von Neumann, who did so much to lay the groundwork for it, anticipated the information revolution. Neither did anyone imagine the biological revolution or nanotechnology. The future of science seemed to lie in the study of atomic power. Islamism was not mentioned, and authors still assumed that time was on the side of the Soviet Union.

Understandably enough, the writers tended to draw straight lines from the present. In their view, past predictions had proven wrong largely because they were insufficiently optimistic. When speaking of
the future as surprising, they usually referred to the pace, not the nature, of change. The idea of radically contingent events altering the whole direction of change was underestimated. Progress, speed, continuation of present trends: these were the guiding assumptions.

As it happened, the volume was prophetic in another way. It exemplified a growing trend of failed predictions made with supreme confidence. To be sure, not all of these predictions were to be unreservedly optimistic. Perhaps the most widely read economist of his day, John Kenneth Galbraith predicted in 1967 that large corporations would be able to insulate themselves from competition and insure their dominance. These supposedly invincible corporations have mostly been replaced by others, which—like Apple, Microsoft, and Walmart—did not exist or had just been founded in 1967.

Still more famously, Paul Ehrlich—in his 1968 best seller *The Population Bomb*, testimony before the U.S. Senate, commentary on television talk shows, and countless other appearances—predicted that overpopulation would cause a billion people to starve to death within a decade. He foresaw the rapid exhaustion of natural resources. Along with the Club of Rome, Zero Population Growth, and books such as *The Limits to Growth*, he argued that humanity was exhausting limited resources and had already reached the point where catastrophe was unavoidable. *The New Republic* proclaimed that “world population has passed food supply. The famine has begun.”

In fact, the exact opposite was the case. Food supply per capita was growing, and starvation was soon to be a rare problem caused not by undersupply but by government mismanagement and by a lack of income needed to buy existing produce. All the same, the predictions seemed impervious to counter-evidence. “How often does a prophet have to be wrong before we no longer believe that he or she is a true prophet?” asked economist Julian Simon.

Reasoning that if resources were to be exhausted, their price would rise, in 1980 Simon challenged Ehrlich in *Social Science Quarterly* to a thousand-dollar bet. Ehrlich could pick five metals he expected to grow increasingly scarce. If their price rose in ten years, Ehrlich would win the bet and Simon would pay Ehrlich the actual purchase price for those metals; if they fell, Ehrlich would pay Simon a thousand dollars. Ehrlich hurried to accept Simon’s “astonishing offer before other greedy people
jump in.” Because Ehrlich got to choose the metals, and because the most he could lose was the initial thousand-dollar stake while sufficient price rises made Simon's potential losses illimitable, the terms seemed to favor Ehrlich. By 1990, all five metals had declined in price, and Ehrlich wrote Simon a check. It would be hard to imagine a clearer test of a prediction, but Ehrlich still refused to admit he had been mistaken.

For his part, Simon had reasoned that Ehrlich’s Malthusianism, based on a comparison of people to butterflies, overlooked the “ultimate resource” humans possess: ingenuity. Substitution effects, technological innovation, and efforts directed by a price mechanism could alter trends for people as they could not for butterflies. Resources tended to expand, not diminish, as new sources became technologically accessible and new productive methods could use different materials. But the rhetorical power of straight lines, especially if one has staked a great deal on predicting their continuation, is hard to overcome.

It seems that neither the optimists nor the pessimists escape the trap of drawing straight lines and the temptations to see only what supports their views. One has only to program a computer to draw them in order to make one’s projections seem “scientific.”

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Have we grown any smarter? It is easy enough to disparage the wisdom of 1955 (or any other year), just as we look down on earlier social views. Somehow history’s most enlightened people are always ourselves at the present moment. The contributors to The Fabulous Future made fun of the wrongheadedness of past predictions, such as the 1844 declaration by the U.S. commissioner of patents that “the advancement of the arts from year to year taxes our credulity and seems to presage the arrival of that period when further improvements must end.” But they did not foresee how wrongheaded their own predictions would prove. If extrapolating from the past shows anything, it shows the hazard of extrapolating from the past. Perhaps the easiest thing to predict is the failure of widely accepted predictions. Astrology never dies, it only changes shape.

Surely it would be hard to assemble a group any smarter than these authors of sixty years ago. If they were wrong, it was not because of a lack of brain power. And so it is reasonably safe to assume that our best guesses will look as absurd half a century from now as theirs do today—or even
more so, if the pace of change accelerates. After all, changes interact un-
predictably with other changes in an ever-broadening spiral.

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And yet, we cannot not predict. It is impossible to focus only on the pres-
ent. We have to allocate our resources somehow, and if we are not to rely
on pure chance, we must guess where they will be most needed or most
productive. Every plan contains a prediction.

What’s more, humanness itself entails anticipating a future. That is
how we experience time. People live each moment as a step to moments
to come. Every present contains multiple possible futures to which we
orient ourselves; suspense is always with us. What’s more, life would
seem pointless otherwise, because unless the future is uncertain, unless
it depends in part on what we do, human effort wouldn’t matter. Action
has meaning only if it can make a difference, and it can make a difference
only if the future hangs in the balance.

For this reason, Dostoevsky argued that the real cruelty of capital
punishment lies in its certainty. Its greatest horror resides in what hap-
pens to the condemned before the execution, at the sentencing. From the
moment the prisoner hears he must die and no longer can entertain any
hope, he surrenders the sense of a future in which effort matters. Before
losing his life, he loses his humanness. Dostoevsky concluded that “mur-
der by legal sentence” is far worse than murder by brigands, from which
there is always hope to escape.13

We can learn a lot about people or cultures from their sense of possi-
ble futures. They are in part defined by the futures they entertain. Even
ill-grounded predictions reveal the horizon of expectations of the people
who make them. To understand their choices, one needs to know the dan-
gers they deemed likely and the achievements they thought possible. The
common wisdom in 1955, however mistaken, illuminates what life felt like
then.

To live in 1955 meant presuming that atomic physics, if it did not
lead to annihilation, would provide endless supplies of power. It entailed
anticipating inequality to lessen; the workweek to shorten; and war, dis-
ease, and natural disasters to disappear, or all but disappear, in the face
of human progress. Today we have an equivalent list of truisms about
the future—call them “futurisms”—which do not seem naive precisely because they are ours.

If we are to understand the past, we must imagine past futures, those shadowy might-bes anticipated at earlier moments. Every past was an earlier present, and it looked out on apparently likely futures. The history of humanity includes all those futures that never were. Even in our personal lives, we can best recall our earlier selves by evoking that to which we once looked forward. Just as respect for human difference involves seeing the world as other cultures do, so it involves seeing it as earlier ages did.

If we neglect to do so, we are bound to smile complacently at those who did not foresee the world we experience today. How could they have been so stupid as not to have guessed what was so plainly bound to happen! We have a natural tendency to think that because the past did lead to us, it had to. We forget, or do not wish to consider, that what happened could easily not have happened, that the world could have been entirely different, and that current conditions are perhaps the result of successful efforts to avoid a much more likely outcome. It is unsettling to think that, but for all sorts of contingencies that easily could not have happened, we would not be here at all.

Wisdom begins when we surmount our own perspective and see what seems plausible to someone with experiences different from our own. Once we realize that history did not lead infallibly to ourselves, we are less likely to succumb to the hubris of the present moment, the sense that, unlike all those fools of the past, we have freed ourselves from prejudice and can see facts clearly.

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How should predictions be assessed? And how can we learn from the failure of earlier predictions?

The fact is, most people make sure not to learn. No one likes to admit he or she was badly and publically mistaken, and so no matter what happens, people assure themselves that they were—or soon would be—proven correct. We have never seen a New York Times or Wall Street Journal editorial admitting that the people it criticized as “in denial” turned out to be right.
The English poet Sir John Harrington famously remarked in 1618:

Treason doth never prosper. What’s the reason?
For if it prosper, none dare call it treason.14

In much the same spirit, we could add:

No forecasts ever err. And why not some?
For if they err, success is still to come.

If what we predicted didn’t happen, we can always imagine it still might.

In his magnificent study *Expert Political Judgment: How Good Is It? How Can We Know?* Philip Tetlock catalogs a variety of excuses given by predictors in the face of evident failure.15 Ehrlich famously compared Simon to “a guy who jumps off the Empire State Building and says how great things are going as he passed the tenth floor.”16 Thirty years after the bet, it is now abundantly evident that food production per capita has not collapsed but dramatically risen. Technological innovation has led to previously impossible extraction of oil and gas (as well as new sources of green power). Nevertheless, in a sequel to *The Population Bomb*, *The Population Explosion* (1990), Paul and Anne Ehrlich claimed complete vindication: “Then the fuse was burning; now the population bomb has detonated.”17 And in 2013 Ehrlich told an interviewer that *The Population Bomb* had proven “much too optimistic.”18

In resisting disconfirming evidence, and in his repeated reference to opponents who cite such evidence as idiots and ignoramuses in denial, Ehrlich is far from alone. In their classic study of religious movements that forecast the imminent destruction of the world, *When Prophecy Fails*, Leon Festinger, Henry Riecken, and Stanley Schachter demonstrate that, often enough, the reaction to disconfirmation is to double down on the original beliefs. Indeed, the more thoroughly people have staked their reputations on a prediction, the less likely they are to reverse themselves no matter how incontrovertible the unwelcome facts turn out to be.

Suppose an individual believes something with his whole heart; suppose further that he has a commitment to this belief—that
he has taken irrevocable actions because of it; finally, suppose that he is presented with evidence, unequivocal and undeniable evidence, that his belief is wrong; what will happen? The individual will frequently emerge, not only unshaken, but even more convinced of the truth of his beliefs than ever before. Indeed, he may even show a new fervor about convincing and converting other people to his view.\textsuperscript{19}

Recalculation of the date is far from the only way to rescue a failure. Forecasters can always claim the predicted event \textit{almost} happened. Sure, Canada didn’t break up by 2000, but someone who assured us it would can protest that it came awfully close to doing so. Or that person can say that the prediction \textit{would have} come true if not for the warning in the prediction itself—an excuse we might call “the self-defeating prophecy.”

Often enough, people maintain that in spite of an outcome the exact opposite of what they forecast, the prediction was confirmed anyway. If an economic or social policy supposed to dramatically decrease crime, unemployment, or inflation is actually followed by no change or even by an increase, well, the problem would have been still worse without the policy! While in some instances they might actually have a case here, it is especially difficult to prove such a counterfactual. Alternatively, one can adjust the prediction by finding some \textit{other} problem that \textit{did} improve and claim credit for that. No one determined not to be wrong ever thinks he or she is.

In August 2000, the quantitative modelers of presidential elections at the American Political Science Association were unanimous that election campaigns did not matter and that in November Al Gore would certainly and decisively defeat George W. Bush.\textsuperscript{20} Almost no one in the Slavic or Sovietology professions predicted the fall of the Soviet Union, but at conferences afterward speaker after speaker responded with outrage to the suggestion that perhaps professionals had left something out of their models or needed to rethink their methods.

There is no shortage of loopholes. Luck is a vastly more popular explanation when one has been proven wrong. It is also always possible to argue that one’s opponents proved right for the wrong reason. One can apply laxer standards to one’s own predictions than to those of others. And in a pinch, one can plead that the consequences of being wrong
were minor compared to the disaster had they proven right. As Tetlock observes, “political belief systems are at continual risk of evolving into self-perpetuating worldviews, with their own self-serving criteria for judging judgment and keeping score, their own stock of favorite historical analogies, and their own pantheons of heroes and villains.”

Tetlock concedes that sometimes explanations of apparent disconfirmations might be persuasive. Sometimes one does fail by luck and some predictions turn out right for the wrong reason. But if we always argue that way, if we never seriously entertain counterevidence or admit our mistakes, we condemn ourselves to never learning from experience. And we commit a form of intellectual dishonesty.

If one is to avoid such dishonesty, it is important to practice what Tetlock calls “the art of self overhearing.” One must train oneself to listen to one’s rationalizations and ask how one would respond had one’s opponents used one’s preferred loophole. Specifying in advance what would prove one’s prediction wrong also helps. It is hard to admit that one’s judgment has failed, but it is even more difficult to learn unless one does.

Tetlock’s study concludes that how one thinks makes more of a difference than what one thinks. It does not matter much whether someone is a liberal or conservative, doomster or boomster, realist or institutionalist. Neither does one’s field of expertise. What turns out to make a difference is one’s style of thought. To explain his point, Tetlock borrows Isaiah Berlin’s famous distinction between “hedgehogs” and “foxes,” terms drawn from the ancient Greek poet Archilochus: “The fox knows many things, the hedgehog one big thing.” Hedgehogs are the grand and bold systematizers, who identify a comprehensive explanation for everything, like Hegel, Spinoza, Marx, or Freud. Foxes, by contrast, tend to find contradictory forces, irreducible complexity, and the need for multiple perspectives. And, by and large, Tetlock argues, it is the foxes that prove more accurate and more capable of learning from experience.

** In assessing predictions, it is important to distinguish three sorts of claims.

First, there is the prediction itself, the content of the forecast. Second, a prediction can allow for more or less uncertainty in the range of
possible results. Third, and most often overlooked, it can be offered with different degrees of confidence.

Suppose we imagine that a social process resembles flipping a coin. It has two equally likely outcomes. We might predict that in a thousand flips, heads will come up “about 500 times.” If we know probability theory, we might allow for a degree of uncertainty and assign a percentage likelihood that the outcome would be in a given range, say, between 400 and 600. Finally, we might be more or less confident of this prediction. How sure are we that the process really does resemble a coin flip? Could there be more than two outcomes, some not specifiable in advance? Is it possible that early results could constrain later ones? Could exogenous forces upset the entire system? To the extent that we answer these questions affirmatively, our degree of confidence should diminish.24

One ought to have supreme confidence regarding astronomers’ predictions about the orbit of Saturn. To the extent one imagines social sciences to resemble astronomy, one will have similar confidence in its predictions. Conversely, to the extent that one thinks that too many factors, some not even imagined, could have concatenating and unpredictable effects, one’s degree of confidence ought to be considerably less.

Overconfidence often results from not recognizing the possibility that a model adapted to fit some circumstances may have strayed into others. Ehrlich’s certainty depended on his confidence in his field of expertise, ecology, but his prediction involved factors studied by economists, who were more likely to question his model. It is one thing to predict global climate change but quite another to maintain that a given treaty will be worth the cost of implementing it.

Degree of confidence makes a big difference. One bets the farm on an outcome that can’t fail to happen. But one bets a lot less, and continually monitors results, when one expects the unexpected.

A prediction can be reasonable when overconfidence in it is not. It is obvious that one cannot devote 20 percent of one’s resources to preventing each of a hundred predicted disasters, so one needs to know not only how likely a predicted disaster is, and how disastrous it would actually be if it happened, but also the degree of confidence we should have in our predictions.

Sometimes it is difficult to assess the prediction but easy to tell that nothing could justify the predictor’s supreme confidence. He or she
might be claiming knowledge no one has ever had. Or be extending the model far beyond its proper domain. Or be making predictions excessively precise, as if more decimal points signaled greater accuracy. Or, out of a sense of urgency, be exaggerating his or her confidence to inspire action.

One can state as a rule of thumb that the more a prediction accords with what one would be inclined to believe for other reasons, the more suspect it is. We do not trust polls undertaken by a political party or an organization allied with it. Groups that have a financial stake in widespread fear of a given disaster risk exaggerating their evidence. It is usually shepherds who cry wolf.

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Some contributors to *The Fabulous Future* wrote as if no reasonable person could question their predictions. Sarnoff declared that “it can be taken for granted that before 1980 ships, aircraft, locomotives, and even automobiles will be atomically fueled.” ²⁵ He was doubly wrong, mistaken not only in his prediction but also in his assurance that he simply had to be right. Explaining how he had given his engineers orders for seemingly impossible inventions that they succeeded in creating, Sarnoff concludes that “there is no longer margin for doubt that whatever the mind of man visualizes, the genius of modern science can turn into functioning fact.” ²⁶ “Taken for granted,” “no margin for doubt,” “every educated person agrees”: these are phrases to be used with caution and are almost never justified when applied to social or political affairs.

By contrast, von Neumann was much less confident. He was often wrong, but not doubly so, in the way Sarnoff was.²⁷ Experience, he warned, teaches that future technological and social changes “are not a priori predictable and that most contemporary ‘first guesses’ concerning them are wrong.” It follows that “one should take neither present difficulties nor proposed reforms too seriously.”²⁸ Crawford Greenewalt began his essay explaining that prediction is hazardous, in part because small changes may lead in many directions and interact in unforeseeable ways. What Greenewalt calls “bit-by-bit research . . . the day-to-day effort that produces results which over a short period seem inconsequential, but which over the long run are extraordinarily important,” makes it impossible to see very far ahead.²⁹
The present effort differs from *The Fabulous Future* in a number of ways. First, the contributors are for the most part less optimistic. The future may not be so fabulous. In 2040, Americans may very well envy previous generations. Second, the 1955 contributors speculated on any topic that struck them. They went far beyond their field of expertise. By contrast, we asked the authors to write about topics both specific and grounded in their specialized knowledge. Third, as the volume’s changed subtitle suggests, our perspective is less U.S.-centric. In 1953 Charles E. Wilson, the president of General Motors, told Congress: “For years I thought that what was good for our country was good for General Motors and vice versa. The difference did not exist.” By the same token, it was taken for granted that what was good for the USA was good for the world. Today, the future importance of the United States is much more of an open question. Finally, the volume reflects a greater awareness of the limits of even the best-informed people’s ability to predict. By and large, we are less sure of our prophetic abilities. We don’t think we are any smarter than our predecessors and expect that, decades hence, when people look back on this volume, its predictions will seem as wrongheaded as those of its predecessor. But perhaps it will seem less brazenly confident. Humility, history suggests, is a great virtue when imagining the future.

Notes

2. The 2006 German film *The Lives of Others* (*Das Leben der Anderen*) focused on a Stasi agent who, assigned to monitor a famous playwright, eventually becomes deeply involved in his life. New technologies imply that there no longer needs to be such a one-to-one ratio for a nation to keep tabs on its citizens.
4. The term “futuribles” belongs to Bertrand de Jouvenel. As he defines the term, it means “possible futures, with an emphasis on the plural; what is implied by
this denomination is our strong conviction that ‘the present state of affairs’ has different possible descendants, is not a given merely unknown but an outcome which may be this or that according to intervening actions.” See Bertrand de Jouvenel, “Futuribles” (lecture, January 1965), 1, http://www.rand.org/content/dam/rand/pubs/papers/2008/P3045.pdf.


9. Ibid., 134.

10. Ibid., 135.

11. On the danger of such extrapolation in international economics, see Ruchir Sharma, “The Ever-Emerging Markets: Why Economic Forecasts Fail,” Foreign Affairs 93, no. 1 (January/February 2014): 52–56. Commenting on the failure of the BRICs (and the CIVERS and the MISTs) to live up to expectations, Sharma observes: “History shows that straight-line extrapolations are almost always wrong. Yet pundits cannot seem to resist them, lured on by wishful thinking and fear” (52). The reason is that “a would-be forecaster must track a shifting list of a dozen factors, from politics to credit and investment flows, to assess the growth prospects of each emerging nation over the next three to five years—the only useful time frame for political leaders, businesspeople, investors, or anyone else with a stake in current events” (56).


17. Ibid., 197.


25. *Fabulous Future*, 17, emphasis added.

26. Ibid., 16, emphasis added.


29. Ibid., 101.
