Critical Terms in Futures Studies

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CHAPTER 20

Forecasting

Arunabh Ghosh

In statistical terms, forecasting is usually understood as calculating the magnitude or probability of a quantity or event at some future time. It is distinguished from estimation, which is typically an attempt to assess the value of a quantity already in existence. Put differently, "the final yield of a crop is 'forecast' during the growing period but 'estimated' at harvest" (Dodge 2003: 153). While accurate, such a definition provides little sense of forecasting's long and varied history. Arriving at some degree of knowledge about future events has motivated human thinking and action since time immemorial. The elusiveness of such knowledge was frequently cast as the nebulous nature of divine will. For the powerful, such as kings and rulers, matters of concern included their own longevity, success in battle, the birth of an heir, the prospects of rainfall or a cold winter, the occurrence of natural disasters or astronomical events which could delegitimize their rule, and much else. Those not located in the ruling classes also sought to determine their future prospects, their concerns fundamentally similar to their rulers, if different in scale and scope. Over the centuries, a range of techniques and tools came to be deployed to forecast these futures: horoscopes, divinations (CF. KEYWORD DIVINATION), auguries, omens, haruspicy (the study of animal entrails), palmistry, and astrology, to name but a few. Most of these we can classify as essentially

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qualitative in nature, relying on the subjective expertise and judgment of the forecaster. The one outlier is astrology, which relied (and continues to rely) on the precise mathematical charting of astrophysical phenomena. These mathematical results are then interpreted qualitatively for predictions about the future. Not surprisingly, the professional forecaster enjoyed significant influence and prestige in society, and evidence for the existence and continuing popularity of forecasting can be found in every culture throughout human history.

Starting in the seventeenth and eighteenth centuries, developments in mathematics, particularly those dealing with statistical and probabilistic ideas, significantly expanded the ways in which forecasting could be carried out (Daston 1988). This was a period during which objective knowledge came increasingly to be associated with numerical data. For instance, financiers in Britain were among the first to derive mathematical formulas to assess the future value of a current asset or, conversely, the current value of a future asset (Deringer 2018). In similar fashion, the French physiocrat François Quesnay (1694–1774) produced a quantitative model of the entire economy (the *Tableau Economique*; 1758) that could be used as a tool to plan future production. His colleague, Anne-Robert-Jacques Turgot (1727–1781) was the first to articulate quantitatively what economists today call the law of diminishing returns. In 1793, their contemporary, the Chinese official Hong Liangji (1746–1809), forecast demographic and dynastic collapse in the face of unchecked population growth, anticipating Robert Malthus by a few years (Rowe 2018). At a broader societal level, these changes were themselves reflections of shifts in social, scientific, and economic organization embodied in the rise of capitalism, the modern state, and imperialism.

By the second half of the nineteenth century, mathematics—in particular probabilistic mathematics—came to be applied across an increasingly wide range of pursuits, from the hard sciences to the newly emergent social sciences (Porter 1986). At the same time, as design and engineering projects took on an ever-increasing degree of complexity, the urgency to mitigate catastrophic outcomes, to control for risk and uncertainty, also grew. Central to the probabilistic turn was an emphasis on discovering causal mechanism that could explain both an existing reality as well as predict future outcomes. To generate a forecast, it was essential to understand why or how a process unfolded. An enthusiasm for the collection and analysis of data was a natural corollary and extended to every domain imaginable, from weather to prices to crime. The development of mechanical and subsequently digital computing by the middle of the twentieth century only added fuel to the fires of this ambition (Wiener 1950). Science fiction writer Isaac Asimov was swept up in the excitement, creating for his Foundation series of novels the discipline of "psychohistory," a blending of history, psychology, sociology, and mathematical statistics that made possible generalized predictions about the distant future (Asimov 2012).

For much of the twentieth century, forecasting occurred along two broad and inter-related approaches. The first, drawing upon antecedents in the nineteenth century, expanded the scope of probabilistic methods to produce a range of forecasting tools. The evolution of weather forecasting—the original impetus for the development of super computers that could process masses of weather data—remains exemplary of this ambition (Roulstone and Norbury 2013). Today, we see highly sophisticated forecasting models deployed in everything from finance to sports and from politics (elections) to the weather. The second approach centered around the idea of economic planning, wherein targets for production (and other activities) were set based on models that forecast future needs, say for raw materials, in light of declared aspirations (CF. KEYWORD PLANNING). Of course, these formal mathematical approaches did not displace the longstanding reliance on older methods such as divination, horoscopes, and palmistry, which continue to enjoy tremendous popularity in most societies of the world today.

The most recent developments in the world of forecasting are driven by technological leaps that have been made in the past few decades, both in the expansion of data collection and storage and in the tremendous increase in computational capacity (Jones 2018). The result calls into question the probabilistic turn's emphasis on modeling causal mechanisms. Instead, given the abundance of data today and the sophistication of machine learning algorithms, data scientists have begun to claim that it is no longer necessary for us to come up with causal mechanisms (the why) in order to predict what may happen in the future (Dick 2015). The implications are transformative, because they undermine the role of human beings in establishing and evaluating normative standards (Guszcza and Maddirala 2016). States such as China are already experimenting with this technology in certain provinces, combining real-time video data with personal data to anticipate criminal acts. Philip K. Dick's Precrime Division in *Minority Report* (1956) is therefore a more realistic possibility than we may acknowledge (Dick 2017 [1956]). And it relies not on mutants but on the ability to process unimaginably vast amounts of data (Chin 2018).

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