

conditions are ripe." In the case of the avalanche, there will often be complicated combinations of slope, terrain, saturation, and snow-layer binding that set up the instability. The historical sequence of epistemic virtues also supplies something close to preconditions of instability. Even if conditions are known to be extremely dangerous, no one could say precisely when — or how — an avalanche might start. Like the formation of an avalanche, the potential for a previous epistemic virtue to be transvalued into an epistemic vice is localized in time, but not with on-the-dot punctuality. Just as in the case of the avalanche, preconditions must coincide with contingent circumstances. We can identify a rapidly proliferating and mutually conflicting set of ideals, each claiming to be the right way to depict the splash of a drop or the structure of a blood cell. We cannot say exactly when or why in a given domain scientists will begin to insist upon an "objective view." Rather than razor-sharp boundaries between periods, we should therefore expect first a sprinkling of interventions, which then briskly intensify into a movement, as fears are articulated and alternatives realized — the unleashing of an avalanche.

But the ambitious historian may persist: Isn't this problem, aren't all problems of historical timing, just due to insufficient information? If some Laplacean demon would turn its infinite industry and intelligence to a complete specification of all the circumstances at a given time and place, wouldn't it be possible to explain the emergence of objectivity — or, for that matter, the outbreak of the French Revolution, the invention of the magnetic compass, the rise of chivalry, yes, even the onset of an avalanche — with pinpoint precision? This is a persistent and revealing historical fantasy. It is fantastical to imagine that we can deterministically identify not only the "trigger" in historical processes — but also the detailed route of development. It is impossible not only because it is practically beyond our grasp, but also because it is incoherent. Just as in the case of the utterly useless Borgesian map that reproduces an empire in one-to-one facsimile, the Borgesian archive of all historical information would duplicate history, not explain it. Forget the thousands of microtriggers. Our interest here is, on the one hand, to capture the conditions of epistemic instability, and, on the other, to identify the new patterns that result — the most striking of which was objectivity.

Objectivity in Shirtsleeves

By this point, many readers will be perplexed by what is missing in this book about scientific objectivity. Some, persuaded that objectivity is a mirage, will ask: Where are the criticisms of the epistemological pretensions of objectivity? Does anyone really still believe in the possibility of the view from nowhere, a God's-eye perspective of the universe? Others, all too convinced of the existence of objectivity, will demand: What about the moral blindness of objectivity, its monstrous indifference to human values and emotions? Isn't overweening objectivity the culprit in so many techno-scientific disasters of the modern world? The one side doubts the possibility of objectivity; the other, its desirability. Both sides will protest in chorus: How can an account of the epistemological and moral aspects of objectivity decline to grapple with these questions?

Our answer is that before it can be decided whether objectivity exists, and whether it is a good or bad thing, we must first know what objectivity is — how it functions in the practices of science. Most accounts of objectivity — philosophical, sociological, political — address it as a concept. Whether understood as the view from nowhere or as algorithmic rule-following, whether praised as the soul of scientific integrity or blamed as soulless detachment from all that is human, objectivity is assumed to be abstract, timeless, and monolithic. But if it is a pure concept, it is a less like a bronze sculpture cast from a single mold than like some improvised contraption soldered together out of mismatched parts of bicycles, alarm clocks, and steam pipes.

Current usage allows a too easy slide among senses of objectivity that are by turns ontological, epistemological, methodological, and moral. Yet these various senses of the objective cohere neither in precept nor in practice. "Objective knowledge," understood as "a systematized theoretical account of how the world really is," comes as close to truth as today's timorous metaphysics will permit.²⁹ But even the most fervent advocate of "objective methods" in the sciences — be those methods statistical, mechanical, numerical, or otherwise — would hesitate to claim that they guarantee the truth of a finding.³⁰ Objectivity is sometimes construed as a method of understanding, as when epistemologists ponder how reliance "on the

specifics of the individual's makeup and position in the world, or on the character of the particular type of creature he is" might distort his view of the world.³¹ And sometimes objectivity means an attitude or ethical stance, which is grounds for praise as calm neutrality or blame as icy impersonality — as proof against "blind emotional excitement . . . which in the end may lead to social disaster," or as an arrogant and deceitful pretense, "the God trick."³² The debates in political, philosophical, and feminist circles now raging over the existence, desirability, or both of objectivity in science assume rather than analyze this smear of meanings, leaping from metaphysical claims of universality to moral reproaches of indifference in a single paragraph.³³ This is why conceptual analysis alone seems to be an unpromising tool for the task of understanding what objectivity is, much less how it came to be what it is.

But if actions are substituted for concepts and practices for meanings, the focus on the nebulous notion of objectivity sharpens. Scientific objectivity resolves into the gestures, techniques, habits, and temperament ingrained by training and daily repetition. It is manifest in images, jottings in lab notebooks, logical notations: objectivity in shirtsleeves, not in a marble chiton. This is a view of objectivity as constituted from the bottom up, rather than from the top down. It is by performing certain actions over and over again — not only bodily manipulations but also spiritual exercises — that objectivity comes into being. To paraphrase Aristotle on ethics, one becomes objective by performing objective acts. Instead of a pre-existing ideal being applied to the workaday world, it is the other way around: the ideal and ethos are gradually built up and bodied out by thousands of concrete actions, as a mosaic takes shape from thousands of tiny fragments of colored glass. To study objectivity in shirtsleeves is to watch objectivity in the making.

If we are right about this, then a study like this one should ultimately shed light on the grand epistemological visions and moral anxieties now associated with scientific objectivity. It should be possible to trace how specific practices came to be metaphorically extrapolated by the philosophical and cultural imagination into dreams of a view from nowhere or nightmares about heartless technocrats. It may also be possible to unravel the conceptual tangle of the current meanings of objectivity. If the concept grew historically,

by gradual accretion and extension from practices, it is not so surprising that its structure is confused rather than crystalline. Chapter Seven reexamines these questions from the standpoint of the history of scientific objectivity narrated in the foregoing chapters.

More fundamentally, a historical perspective also shifts the ethical meaning of objectivity. If objectivity seems indifferent to familiar human values, this is because it is itself a code of values. The values of objectivity are admittedly specific and strange: to refrain from retouching a photograph, or removing an artifact, or completing a fragmentary specimen is not obviously an act of virtue — not even to all other scientists, much less to humanity at large. Nor will everyone acknowledge resolute passivity or willed willessness as values worth aspiring to. These are values in the service of the True, not just the Good. But they are genuine values, rooted in a carefully cultivated self that is also the product of history. The surest sign that the values of objectivity deserve to be called such is that violations ignite indignation among those who profess them. Viewed in this light, whether objectivity is a good or bad thing from a moral standpoint is no longer a question about alleged neutrality toward all values, but one about allegiance to a hard-won set of coupled values and practices that constitute a way of scientific life.

Look one last time at the three images with which we began. Each is, in its way, a faithful representation of nature. But they are not facsimiles of nature, not even the photograph; they are nature perfected, excerpted, smoothed — in short, nature known. These images substitute for things, but they are already admixed with knowledge about those things. In order for nature to be knowable, it must first be refined, partially converted into (but not contaminated by) knowledge. These images represent knowledge about nature, as well as nature itself — indeed, they represent distinct visions of what knowledge is and how it is attained: truth-to-nature, objectivity, trained judgment. Finally, they represent the knower. Behind the flower, the snowflake, the solar magnetogram stand not only the scientist who sees and the artist who depicts, but also a certain collective way of knowing. This knowing self is a precondition for knowledge, not an obstacle to it. Nature, knowledge, and knower intersect in these images, the visible traces of the world made intelligible.