

ultimately control metaphors because of their resonance. The solution to this tension lies first and foremost in greater awareness of the social dimensions of metaphors in environmental science, an awareness that, I hope, this book will help generate. The solution also lies in a vision of engaged citizens and scientists collectively generating a plurality of metaphors, and scientists acting as honest brokers. This would allow open discussion and debate over alternative metaphors and associated values in the interest of providing a vista of possibility for creating a more sustainable future. But this sounds quite progressive, so it is to the metaphor of progress that I now turn.

II

Progress

A Web of Science and Society

*Darwinism is social because science is. And of all science
the theory that links humanity to the history of nature
is likely to be most so.*

—Robert Young, “Darwinism Is Social”

*If we were not so single-minded
about keeping our lives moving,
and for once could do nothing,
perhaps a huge silence
might interrupt this sadness
of never understanding ourselves
and of threatening ourselves with death.
Perhaps the earth can teach us*

*as when everything seems dead
and later proves to be alive.
—Pablo Neruda, "Keeping Quiet"*

The metaphor of progress weaves a tangled web of science and society. One scholar has defined progress as the idea that "mankind has advanced in the past—from some aboriginal condition of primitiveness, barbarism, or even nullity—is now advancing, and will continue to advance through the foreseeable future."¹ This denotative definition places the emphasis on human *cultural* progress, but progress has greater significance as one of the grand metaphysical meta-narratives in contemporary Western societies. As such, it takes on multiple guises that apply in different realms and give it a mythic quality and hence a large role in the constitution of our worldview. In this chapter, I wish to examine progress as a feedback metaphor, tracing its interconnection with biology, its transformation over time, and its relevance for thinking about socioecological sustainability.

People lived and breathed progress in Victorian England. Although progress was implicit in the ancient idea of the Great Chain of Being, it came into its heyday in the eighteenth and nineteenth centuries because of the continued technological success of science. In accord with the definition of cultural progress, British citizens saw themselves as the vanguard in the long march of human history. Furthermore, once Charles Darwin showed that humans had evolved from other species,

it became quite intuitive to think of cultural progress as simply the cutting edge of earlier *biological* progress. The metaphor of progress allowed society to personify nature in its own image, confirming the idea that we were the apotheosis of creation and that the way humans *were* was the way evolution had been aiming. The metaphor thereby united the social and natural worlds, as it was applied to the natural world and then back onto humanity (Figure 2, chapter 1).

Evolutionary biologists were not immune to such metaphoric transference. In his magnum opus, *Monad to Man: The Concept of Progress in Evolutionary Biology*, the philosopher Michael Ruse concluded, "Evolutionary thought is the child of [cultural] Progress."² He demonstrated that biologists driven by progress-oriented political agendas searched for evidence of biological progress to confirm that cultural progress is natural. This trend was particularly noticeable among popularizers of evolution such as the English philosopher Herbert Spencer, whose writings entrenched progress within the public notion of evolution. But progress also became a constitutive metaphor within evolutionary biology itself, dramatically influencing the theories of such leading evolutionary biologists as Ronald A. Fisher, an Englishman, and Sewall Wright, an American, into the 1930s and 1940s. The distinction between progress as an empirical biological question and as a social perception became increasingly blurred.

Later in the twentieth century, however, the era of progress began to wane. Although many critics had earlier questioned the narrative of progress, including some who sought to counter what they saw as widespread social degeneration, it became increasingly difficult to view human history in a progressive light because the dark side of scientific and technological development became apparent: world wars and environmental

degradation. Elsewhere, eugenicists' attempts to spawn cultural progress contributed to the horrors of Nazism. In the late 1960s, the American evolutionary biologist George C. Williams wrote an influential book that lambasted biological progress because it violated epistemic norms, and also because no matter how progress was defined, humans always came out on top—an unacceptably blatant personification.³ Its rejection was not just epistemically based, but rooted in a broader cultural context. Nonetheless, we have limited knowledge of the current status of biological progress, though as we will soon see, progressive biological metaphors live on in one form or another.

Contrasting Views of Biological Progress

To obtain insight into the current status of progressive metaphors and how they interweave science and society, I conducted an Internet-based survey of members of four organizations. Respondents were asked, among other things, to evaluate eighteen statements containing competitive and progressive evolutionary metaphors. There were 1,892 usable responses. Here I focus on the contrasting response of members of two organizations, the Society for the Study of Evolution (SSE) and the Foundation for Conscious Evolution (FCE), whose members I will refer to, respectively, as the evolutionary biologists and the evolutionaries.⁴ For simplicity's sake, I will not discuss results for two other organizations, the Human Behavior and Evolution Society and the National Association of Biology Teachers, until the next chapter. Although I would have liked to survey members of other organizations, such as the Ecological Society of America, their policies did not allow the release of membership information essential for survey participation.

I will focus on their response to a single, representative

statement, "Progress typifies the evolution of life on earth." Respondents were asked to evaluate this statement in terms of the following pair of questions: "Do you believe [this statement] to be factually true? In your opinion, has biological research provided sufficient evidence to support it?" With these questions I sought their view of the veracity of progressive evolution, although it is important to recognize that the statement operated at the level of a gestalt because it asked respondents to characterize evolution as a whole, generalizing beyond specific empirical cases as well as the exceptions that always operate in biology. Despite this limitation, the results discussed here were supported by a factor analysis of the other progress-related statements in the survey.⁵

The survey found that evolutionary biologists agreed with this statement much less than the evolutionaries: 46 percent of the former strongly disagreed with it, compared to only 8 percent of the latter (Figure 3).⁶ To interpret this result, we can begin by looking at results for the former organization. The SSE is the world's largest organization of evolutionary scientists, comprising 2,900 members in fifty countries who promote "the study of organic evolution and the integration of the various fields of science concerned with evolution."⁷ Its members claim a long lineage to Darwin himself; many refer to themselves as neo-Darwinians. It is hence unsurprising that they had more formal education about evolutionary biology than the evolutionaries, which would certainly have influenced their response to questions about biological progress.

Evolutionary biologists' rejection of the notion of biological progress relates to their belief in *scientific* progress. Ruse demonstrated that biological progress became less and less popular among evolutionary biologists through the past century in part because of doubt about cultural progress, but

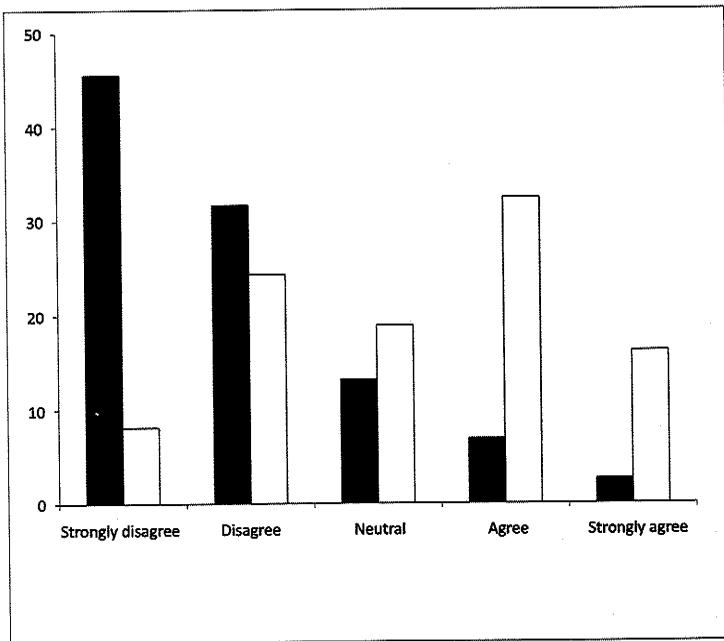


Figure 3. Percentage of the evolutionary biologists (dark bars) and evolutionaries (light bars) who disagreed or agreed with the survey statement "Progress typifies the evolution of life on earth."

predominantly because they had to exclude the cultural values of biological progress to professionalize their field into a valid scientific discipline. To progress scientifically, they had to reject biological progress. Additional results from the survey support this contention. Three-quarters of the evolutionary biologists strongly agreed with the statement "Our understanding of evolution is better than it was 100 yrs ago."⁸ Although this might seem commonsensical, it nonetheless contains a value judgment that will be discussed below.

Even if evolutionary biologists have rejected progress,

however, that does not mean that their worldview is any less metaphorical. As Robert Richards, a University of Chicago historian and philosopher of biology, elegantly stated, "Neo-Darwinians seem to have reached general agreement that [the proposal] that evolution is progressive . . . should be dismissed. These ideas, nonetheless, were the very seeds of Darwin's thought. And if one pries back the husks of rhetoric, these earlier stages in the formation of evolutionary theory can, with a little imagination, be yet discovered forming the fetal structures of the views of many contemporary neo-Darwinians." Whereas only 9.5 percent of them agreed or strongly agreed with the statement about progress, for example, fully 50.5 percent of them did subscribe to a statement that simply replaced "progress" with "increasing complexity": "Increasing complexity typifies the evolution of life on earth." Some biologists have touted complexity, another metaphor, as an objective measure of progress, but it is notoriously difficult to quantify, and any increase is neither uniform nor universal because many lineages do not progress at all—or at least not most of the time. An increase in complexity over time could also result from what is known as a random walk: if organisms were very simple to begin with, then evolution can only increase their complexity. Even the desire to quantify complexity could derive from an interest in confirming that *something* progresses; hence, the Duke University evolutionary biologist Daniel McShea wondered, in his empirical review in the pages of the journal of the SSE, *Evolution*, whether "the word 'complexity' (as it is commonly used) is just a modern substitute, a kind of code word for perfection, progress, and proximity to us."⁹

In contrast to the evolutionary biologists, most evolutionaries agreed that evolution is progressive. Centered in Santa Barbara, California, this small group passionately seeks to apply

evolutionary thought to directing human evolution. Their acceptance of progress may also mirror broader societal views demonstrated by the movie *Evolution* (in which evolution is equated with a growth in complexity), by ads showing humans as the apex of hominid evolution, and by other examples. Rather than rejecting the concept of biological progress, as evolutionary biologists did, it is likely that the evolutionaries accept it for spiritual reasons. They are much more likely to believe in God and to describe themselves as spiritual than the evolutionary biologists.¹⁰ This accords with a worldview that their Web site explains as follows: "Conscious Evolution is a new social/scientific/spiritual meta-discipline. . . . It is a process of giving direction to the evolution of human systems by purposeful action. . . . The promise of Conscious Evolution is nothing less than the emergence of a universal humanity capable of co-evolution with nature and cocreation with Spirit. . . . The ultimate purpose of Conscious Evolution as a world view is to foster the evolution of our species to full potential, based on the harmonious use of all our powers—spiritual, social, and scientific—in harmony with the deeper patterns of nature and the Great Creating Process itself, traditionally called God." Although this worldview may be unfamiliar, it has been adopted by numerous visionaries operating at the interface between evolutionary biology and society, including Herbert Spencer, the English evolutionary biologist Julian Huxley, the Hindu mystic Sri Aurobindo, and the Jesuit paleontologist Pierre Teilhard de Chardin.¹¹

The evolutionaries have adopted progress as a crucial plank within their spiritual worldview. Biological progress supports their belief in what I call *spiritual* progress, the idea that individual humans progress morally and spiritually through their lifetimes. Spiritual progress was originally thought to occur through Providence, until humanism ushered in a self-

motivated version. This belief derives some support from developmental psychology, which provides evidence for moral maturation through the human lifespan. The evolutionaries demonstrated their belief in such spiritual development by greater agreement than evolutionary biologists with statements such as "Long-term spiritual or religious practices increase one's compassion" and "In general, adults become more spiritual through their lifetime."¹² They have adopted a historical evolutionary narrative consistent with the progressive story on which they base their faith.

Biological progress and spiritual progress are not the only elements of the progressive worldview of the evolutionaries. In particular, we can add another form of progress to the four discussed above, *universal* progress. This form of progress is critical for the evolutionaries because it encompasses the others in a larger framework, forming a progressive cosmic narrative that links the big bang to the origins of galaxies, stars, Earth, life, consciousness, and human culture. Grand cosmologies of this type posit developmental progress for the universe in its entirety. In the words of Eric Chaisson, an American astrophysicist at Tufts University, "What Darwinism does for plants and animals, cosmic evolution aspires to do for all things." Accordingly, universal progress allows the evolutionaries to incorporate the purpose of their lives, which is connected to spiritual progress, with the unfolding of the universe as a whole. Biological progress, spiritual progress, and to some extent scientific progress are elements of this unfolding, an unfolding that was envisioned by both the mystics and the scientists mentioned above who sought an encompassing worldview. Three current expressions of such thought are cosmic evolutionism, the Epic of Evolution project, and the FCE. These narratives intend to provide humans with a scientifically valid creation story, "Everybody's

Story," which can unite us as we design a new future.¹³

The survey detected progressiveness elsewhere in the evolutionaries' worldview. I expected that they would reject the statement "Long-term evolutionary change is often caused by random drift," because of the antiprogressive resonance of *drift*. The survey found that they often attributed evolutionary change to intelligent design and purpose, so the implications of drift would be inconsistent with their belief system. The results supported this prediction: the evolutionaries were nearly twice as likely to reject this statement as the evolutionary biologists.¹⁴ It is unlikely that the evolutionaries understand the technical meaning of evolutionary drift, but even if they did, they would probably still reject it. Until a few decades ago, evolutionary biologists also rejected drift as an important factor in evolution.

The Metaphoric Web of Progress

We have now seen that biological progress has been rejected by one group in the interests of scientific progress, even as another group accepts it in the interests of spiritual progress. Such is the power of polysemy. There is Progress, and then there is progress, of which there are diverse forms that together constitute a metaphoric cluster founded on polysemy. These forms of progress highlight its metaphorical function, its ability to reach diverse domains of human experience. Although it might seem that the evolutionaries represent a fringe group that simply does not have the facts straight, they instead demonstrate how scientific metaphors are actually adopted and used in social contexts. We cannot pretend that they can be limited to their scientific meanings.

Progressive metaphors demonstrate not only how metaphors refer to one thing in terms of another, but also how they

may transfer meanings among discourses. Both senses draw attention to the original Greek meaning of metaphor, "to bear," but the latter more radically expands the usual conception of metaphor.¹⁵ Because of their ordinary roots, scientific metaphors travel between and among scientific disciplines, public policy forums, and disparate social groups. Science is not just some abstract entity; rather, it is conducted by actual people who go home to their spouses, children, neighbors, and newspapers. Conversely, much of the general population is exposed to some science nearly every day. Hence, metaphors move back and forth between these domains on the scale of individual people interacting and talking to one another.

We could use numerous metaphors to conceptualize the role of feedback metaphors like progress in broader science-society interaction. Previous scholars have adopted a "messenger" metaphor,¹⁶ for example, but this suggests a one-way transfer that may too easily invoke the conduit model of communication. It also invokes many of the standard models of metaphor, in which there are discrete source and target domains. Although this model may help us understand metaphors in some contexts, it does not characterize the large-scale, nonlinear feedback among domains in the case of progress or other feedback metaphors.

It is particularly misleading to think in terms of discrete source and target domains when metaphors have entangled cultural and embodied referents. Let us return to progress and consider it at greater length in this context. Progress initially derived from the bodily domain of forward movement, from the Latin *progressus*, which led to its use in the sense of a journey or a march. This did not necessarily imply a goal, but soon the word was applied to a series of events leading toward a better outcome. Progress thus became linked with teleology and the

idea of improvement, which is apparent in the senses of progress discussed here. It has more recently extended to describe political views, where progressive is opposed to conservative; in analyzing its use there, the Welsh novelist and critic Raymond Williams noted, "Progressive is a complex word because it depends on the significantly complicated history of the word progress."¹⁷ This complexity accounts for the interweaving of the senses described here, which obviates the need for speaking of discrete source and target domains.

Alternative metaphors or analogies may better communicate this nonlinear conception of metaphoric movement. As a biologist, I considered various biological possibilities. Two of these, *adaptive radiation* and *evolutionary ecology*, seemed too arcane for nonbiologists.¹⁸ Metaphors might also be like bumblebees, transferring value-laden pollen grains among different floral contexts where they may or may not germinate, but this seemed too convoluted.

In the end, I adopted a web metaphor, which entails the diverse interconnections provided by metaphoric transfer (Figure 4). As Harrington explained, "Metaphors do much more than just lend old lexical meanings to new objects: they are literally ways whereby societies 'build' webs of collective meaning; create what I would call *cultural cosmologies* or meaning-worlds that, once built, for better or worse become the 'homes' in which we reason and act, places that constrain without determining any of our particular conclusions or actions." With this in mind, we see that the web metaphor shares some of the benefits of speaking of the "web of life." It highlights context and shows how metaphors embed science within a greater community, a field of contextual meaning, rather than setting it apart. We cannot neatly isolate scientific and popular interpretations of a metaphor because of the nonlinearity and unexpectedness of



Figure 4. The web of an orb spider.

metaphoric movement. In a web such as this it quickly becomes impossible to specify the “original” meaning of a term. The web metaphor, finally, emphasizes interdependence, thereby recognizing how singular effects spread more widely, perhaps through the whole of society.¹⁹ Just as a spider can detect the vibrations when an insect becomes stuck elsewhere on its web, ingrained metaphoric values can have repercussions in science and society that may be distant in space and time.

This web metaphor has its shortcomings, too. As a network or systems metaphor, it represents our times, what has been called the “network society.” Some scholars argue that such metaphors are overly nonhierarchical; that is, they neglect inequalities and power relations that structure what is there, or in this case the very real relations existing between science and society. Conversely, the web metaphor may suggest greater patterning than actually exists. Rather than envisioning an intricately patterned orb web (as in Figure 4), we must recognize that this web is much more tangled because of the bidirectional movement of metaphors and the chaotic nature of science-society connections.²⁰ Such webs tend to ensnare or entangle. Scientists and nonscientists may become stuck because of the stickiness of metaphoric values—they may not be apparent from a distance (like a spider web), but once you adopt a metaphor and get close to it, these values begin to take on a life of their own. If we settle on a particular metaphor, we may become trapped by it and our creative options become closed. To the extent possible, I propose that we cultivate a more organized metaphoric web, though we will continually encounter the unpredictability of metaphor (see chapter 7).

The web metaphor nonetheless shows that as metaphors migrate, they facilitate the transfer of ideas, values, and perspectives. This is not unusual but, rather, to be expected. Wherever

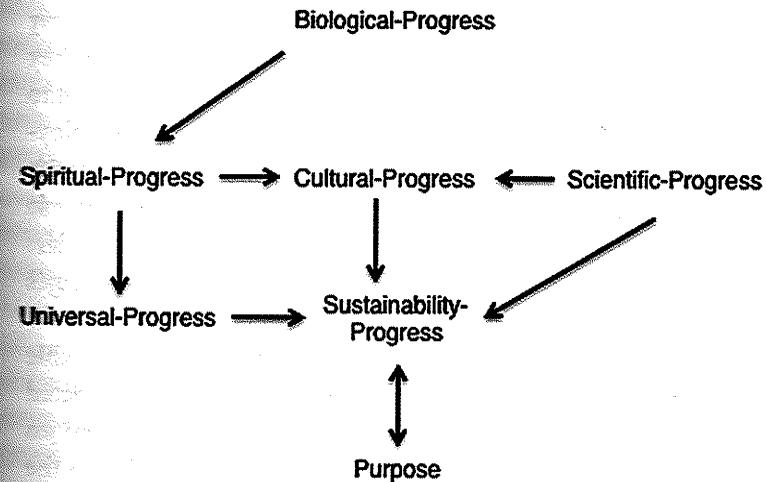


Figure 5. A model of the relation between the different forms of progress adopted by the evolutionaries and the evolutionary biologists; arrows indicate how one form of progress lends support to the existence of another. The evolutionary biologists take the right-hand path to sustainability (via scientific progress, so there is no arrow from biological progress), whereas the evolutionaries take the left-hand side (via spiritual progress). Note the alliance between purpose and sustainability progress. See the text for further details.

they occur, they continue to pull on their associated commonplaces within the web, which include diverse associations and values in addition to technical meaning. In the lingo of recent sociology of science, metaphors provide a linking component within actor networks. Scientists represent just one component within networks that include the objects they study, institu-

tions that support them, journalists reporting on their work, policy makers, citizens, and others. Across such a diverse array of actors, metaphors promote communication because they act as boundary objects, which are “plastic enough to adapt to local needs and the constraints of the several parties employing them, yet robust enough to maintain a common identity across sites.”²¹ In this manner, the metaphoric web allows people of diverse backgrounds to engage with and gain some understanding of scientific topics—notwithstanding the challenges this presents.

Progress exemplifies the metaphoric web, the permeable boundary between science and society. Progress is not restricted to the cultural or scientific domain; the five interwoven versions of progress reveal the extent to which this metaphor crosses the boundaries between domains (Figure 5). One could definitely invoke other types of progress, but for our purposes they can be included with those discussed here. For example, technological progress may be subsumed by scientific progress, economic progress by cultural progress, and religious progress, as propounded by, for example, the Templeton Foundation, by spiritual progress.²²

The metaphoric web might even encompass nonprogressive strains of evolutionary thought based on complexity. Chaisson, whom we met earlier, based his argument for cosmic evolution on a growth in complexity: “Complexity is *a*, and perhaps *the*, key to both deep and broad understanding in the natural sciences. . . . Material assemblages have become increasingly organized and complex, especially in relatively recent times.”²³ Whether or not complexity here is a code word for progress and proximity to us, as McShea suggested, it is being used to think of evolution across scales, from the small, chemical, and biological to the very large, the universe as a whole. This is yet

another layer of the metaphoric web of evolutionary thought: progressive and nonprogressive elements, and teleological and nonteleological ones, interweaving with one another to influence thinking across these domains.

These multiple meanings reinforce one another because of their metaphorical interaction. We cannot keep them distinct in practice or in everyday language, regardless of the extent to which biologists reject biological progress within their domain. Even if they operationalize it, they cannot control how it will be interpreted when they release it back into the cultural web in which it originated. Biological progress is always more than just biological progress. It is a feedback metaphor that links diverse aspects of human life, ranging from our personal expectations for our lives through our understanding of the cosmos as a whole. As a consequence, its meaning cannot be limited to any one sphere because biological progress influences so much of how we think about diverse realms of experience: questions about its occurrence are largely metaphysical rather than empirical. It is an elusive shape-shifter that seems to forever imbue our conception of temporal processes. Thus, it dramatically influences our thinking about sustainability.

Routes to Sustainability Progress

The human species currently faces challenges of an unprecedented scale and magnitude. We are changing the planet, and there is widespread agreement that it is not change for the better.²⁴ Although we may not extinguish ourselves, our actions are leading to a less interesting world and one less supportive of a human presence—let alone the presence of other species. Many people therefore take sustainability as the measure of human activity: does an activity, ongoing or proposed, contribute to

the likelihood that humans and other species will live fulfilled lives on Earth in the future?

In what follows, I propose to add *sustainability* progress to the forms of progress discussed above and adopt it as the critical measure of progress. To put such progress in perspective, Robert Gibson, a Canadian environmental studies scholar, reviewed how the “old sustainability of customary stability” that dominated much of human history gave way to the idea of cultural progress and its eventual idolization over the past few centuries. Even though its costs then came to light, it was not rejected, but “instead, the predominant focus was on finding more viable approaches to progress. The objective was to replace short sighted and merely economic growth with development options that promised more comprehensive and lasting gains. This was the context in which sustainability re-emerged. Unlike the old sustainability, the new version had to be constructed not in a world of tradition and preservation of the tried and true, but in a world of change and devotion to improvement.”²⁵ Although the Voluntary Human Extinction Movement might disagree, I assume that most people, in cultures around the world, could adopt such a vision because they wish human being to continue. It is perhaps a progress that we can all aspire to because it envisions a future in which humans continue to exist and adapt, mutually, with other life on Earth. We may reach such sustainability in various ways, and there is always the risk of succumbing to utopian dreams, yet I will accept it as a reasonable objective for our species.

It might seem ethnocentric to emphasize this notion of sustainability progress. It is certainly still progressive in thinking that there can be a sustainable relation between humans and the planet. I can state only that this is hope in the face of potential nihilism and despair. As the sociologist Robert Nis-

bet concluded in his history of the idea of progress, it has on the whole “done more good, . . . led to more creativeness in more spheres, and given more strength to human hope and to individual desire for improvement than any other single idea in Western history.”²⁶ The trick in the current era is to harness such thinking to sustainability.

To aid thinking about sustainability progress, consider the tale of a man who runs out of an airport and hails a cab. He jumps into the cab and yells to the driver, “Hurry up, I’m late.” The cabbie tears off through the traffic. A few minutes later, the passenger inquires, “Where are you taking me?” to which the cabbie replies, “I don’t know, but I’m going as fast as I can.” I suggest that environmental scientists often behave something like the passenger in this vignette—the taxi being environmental science itself. We’re going as fast as we can, rarely stopping to consider where to go or whether we have found the right means to get there. We tend to focus on the means for getting “there,” giving little reflection to what that “there” is or what the purpose of the striving is. Sustainability thus transmogrifies into sustainable development, allowing the implication of “sustained” development to prevail, despite inadequate focus on lessening it to levels that can truly be sustained.

We can see a parallel issue with the evolutionary biologists and evolutionaries. Both seek sustainability progress in the broad sense just defined, but the specific sense of progress they invoke varies (Figure 5). The evolutionary biologists rely on scientific progress, whereas the evolutionaries commit to spiritual progress, beliefs supported by other portions of the metaphoric web. While this web is alluring, there are liabilities of scientific progress and spiritual progress as routes to sustainability in themselves. In other words, are they the right taxis?

To consider this question, it may help to draw an analogy

with biological progress. We can first clarify biological progress further by defining it as “gradual directional change embodying improvement” through evolutionary history.²⁷ Biologists might find the first element of this definition—gradual directional change—to be empirically unclear, yet they would find it less controversial than the second element—concerning improvement—because gradual change is intrinsic to neo-Darwinian naturalism. We can contrast these two elements with a directional statement that organisms are becoming pinker over time versus the claim that this is progressive improvement because the pinker organisms are somehow better. The latter claim would be more contentious among scientists because of its valuation component.

To develop our analogy, we can then distinguish relative from absolute biological improvement.²⁸ Relative improvement accrues through gradual change against a standard within a lineage over time, which is most evident in directional trends in the fossil record that result from the action of natural selection. Natural selection adapts organisms to the environment in which they occur, and their “fit” may become better over time, representing an improvement. As a simple example, fish are far more at home in the ocean than we are. Nonetheless, a problem arises when we attempt to extend thinking about such microevolutionary progressive processes to a macroevolutionary scale, the realm of absolute progress.

With absolute progress, life improves on the whole even among evolutionary lineages. Absolute progress conforms to the traditional notion of a Great Chain of Being: later organisms scale a ladder toward God. Early biologists invoked this view when they drew trees with a ladderlike main trunk leading to us, unlike more recent imagery, such as that of a bush, which represents the contingency of evolution.²⁹ This shift recognizes

the challenge of providing an unbiased measure of absolute compared to relative progress. What is our absolute standard of progress? Will it be size, complexity, intelligence, DNA content, or some other feature? How will we measure these features? How will we weigh them against one another? Consider that parasite lineages often become morphologically simpler over time, though they simultaneously become more specialized in adaptation to their niche. We might justify using either morphology or specialization, in this example, as evidence of relative progress, but how would we assess ultimate progress? This is a particular challenge, given our propensity for measures that place humans at the apex of evolution.

So how does this apply to the evolutionaries and the evolutionary biologists? I propose that they are taking their own relative form of progress and mistaking it for a more encompassing sustainability progress. Of course, this is not their only objective, but, as outlined above, this axis must be primary in our minds. Consider the evolutionaries’ belief in spiritual progress. It plays a key role in their view of sustainability because the evolution of human consciousness will allow us to solve environmental problems by directing human evolution in a more sustainable direction. This is expressed in their purpose statement: “Those of us alive today are the first generation born with the choice of learning conscious, ethical evolution, or suffering devolution and the destruction of our life-support systems.

... We are the generation of the gap between ‘here’—a highly technological, over-populating, polluting, brilliant species on the brink of social and environmental chaos, and ‘there’—a compassionate, spiritually awakened humanity, capable of transcending the limits of our past human existence and moving toward the unknown.”³⁰ This vision emphasizes the role of spiritual progress as a means toward sustainability progress.

The evolutionaries' adoption of sustainability progress faces a couple of obstacles. Along with the other visionaries mentioned above, such as Chaisson, they tend to validate universal progress with reference to science, biological progress being one of its main elements. As we've seen, however, their views on biological progress contrast markedly with those of evolutionary biologists. It's not that they need to correspond with science if they are to be valid, but rather that if they don't, the evolutionaries may have to rein in the universality of their vision. More to the point, would such spiritual progress lead to sustainability progress? The risk is that spiritual progress can give priority to the human species and thereby isolate us from the natural world. In the words of Gould, "This fallacious equation of organic evolution with progress continues to have unfortunate consequences. Historically, it engendered the abuses of Social Darwinism. . . . Today, it remains a primary component of our global arrogance, our belief in dominion over, rather than fellowship with, more than a million other species that inhabit our planet." One-third of the evolutionaries, for example, agreed with the statement "Humans are the apex of an unfolding universe."³¹ It might have thus seemed consistent for one of them whom I met to advocate spiritual progress yet nonetheless order the killing of a matriarch rattlesnake. Unfortunately, if we humans treat the Earth as passive support for our individual or collective spiritual advance, then this advance may ultimately fail. Relative spiritual advance is not the only route to absolute progress or, put more pragmatically, for humans to develop more sustainable ways of living on the planet.

Let us now turn to the evolutionary biologists, on whom I will focus, given their greater pertinence to the argument of this book. Although the evolutionary biologists reject biological progress, this is partly to support an implicit belief in scientific

progress. We have already seen that they feel that evolutionary knowledge has become better over time. Furthermore, nearly 75 percent of them also strongly agreed with the statement "Evolution is a fact." Taken together, these results demonstrate a strong belief in the solidity of evolutionary knowledge. Evolutionary biologists may emphasize this to counter creationism, yet it may mean they are being as dogmatic as creationists. As Massimo Pigliucci, an evolutionary biologist and philosopher who is known for his incisive critiques of creationism, observed: "Science is a *method*, not simply a particular body of knowledge. . . . Science, if you will, is always about 'very likely maybes,' never about absolute truth. This is a feature that both creationists and scientific fundamentalists apparently find disturbing and that explains quite a bit of the ideological posturing on both sides of the issue."³² The term *fact*, by contrast, has a common resonance that lends stability to scientific knowledge, in contrast to a term such as *theory*. It implies not just absolute scientific progress, but the conclusion that we have already arrived at a solid endpoint.

Scholars have long debated, however, whether science progresses at all. Scientific representations certainly seem to become increasingly accurate over time, so within that relative way of framing things science *does* progress. We must nonetheless ask critical questions, such as whether this frame is the right one, whether the particular values we have adopted in our science are actually the best ones, and whether the benefits of science always outweigh its costs. By emphasizing realms in which scientific progress is ambiguous, many writers conclude that it is fictitious. Science in this view does not provide ultimate truth; instead, following Pigliucci, it provides knowledge that is continually susceptible to revision by future observations and empirical testing. Another philosopher of science, Thomas Kuhn, explained this distinction by contrasting

scientific-progress-from, a local progress from what we knew before, with scientific-progress-to, a progress toward an Aristotelian *telos*—truth.³³ Just as biological progress was compelling and reassuring to evolutionary biologists a century ago, some of them may still believe in scientific-progress-to, toward the truth, and this faith may yet trump critique.

Many evolutionary biologists express concern about biodiversity loss and accent the relevance of their field to conservation initiatives. Does regular scientific progress necessarily lead to this espoused sustainability progress? Like the evolutionaries' spiritual progress, it has a role to play. The unquestioned assumption that any and all scientific knowledge—and associated technology—contributes to sustainability, however, derives from faith in the importance of objective knowledge for solving global problems. Scientists obtain power and become the priests of our era to the extent that they provide a special form of knowledge that can be used to do such wonderful things. And we often consider that the final test of scientific knowledge: we can *do* things with its results, such as applying it to reverse the decline of an endangered species. Regardless, we know now that the linear view of the relation between science and social outcomes is flawed. Science may allow us to do things, but we can assess its contribution to sustainability only by incorporating broader contextual and socioecological questions. We typically think of sustainability as doing something out there in the world, when in fact we may need to first reassess the way we are setting the problem.

If we insist on conceptualizing scientific progress as a linear ascent, perhaps as the growth of a branching tree, I am inclined to focus on the interstices, the spaces between the leaves and the branches, the things we do not now understand and may never understand. Science does not necessarily display

these interstices. Philosophers of science generally agree, for example, that there isn't One Science; rather, there is a "disunity" of sciences, and our understanding of the world is therefore "dappled." The methods of the physical sciences may not reach these interstices; it may even be dangerous to think that these methods apply in the social realm. Accordingly, many young scientists, having realized that the real problems of conservation are interdisciplinary, have redirected their research in this direction despite its career risks.³⁴ We need to question the emphasis on the cutting edge of scientific research, a metaphor implying that it is natural for humans to seek answers to the unknown, rather than perhaps recognizing that some things may be ultimately unknowable or that mystery might make life worth living.

More broadly, we require insights into these interstices from the myriad alternative ways of knowing. This is particularly the case in our species' search for sustainability. Sustainability progress will benefit from plurality rather than a focus on (relative) scientific progress. Instead of assuming that Western science is the solution, we need to open our minds to how diverse people have learned to live on our planet. Our objective, together, is sustainability-progress-from rather than progress-to, as Kuhn described them. We need to ponder how different metaphors contribute to sustainability rather than becoming too attached to our own because, like all metaphors, they highlight one aspect and thus miss out on others. In this way, they demonstrate why it is so critical that we look more carefully at the metaphors we choose to adopt and use as a community of people on the path of sustainability.

A Purposeful Life: Personification and Sustainability

It is easy enough to critique visions of spiritual and scientific progress, but at a deeper level they speak to the metaphoric web of progress and its multiple forms. Why is progress, in one form or another, so compelling? It appeals to people in part because it connects with the common human experience of purpose. In the 1998 General Social Survey in the United States, over 90 percent of respondents disagreed or strongly disagreed with the statement "In my opinion, life does not serve any purpose."³⁵ Embedded in purposeful lives, we are to progress as fish are to water. We have an existential need to ensure that what we are doing matters, that our lives are progressing. This reaches all the way to ultimate questions about the sustainability of the human enterprise.

When we awake each morning, we set out with a purpose—or at least this assumption is associated with a healthy and fulfilled human life. This purpose may be clear, or it may be veiled, but it influences everything we do. It may be as simple as living well and loving our families, or it may mean striving for success or aiming to change the world. We want our incomes to grow, our knowledge and skills to improve, our lives to get better. As scientists, we want our experiments to work, our papers to be published, our careers to unfold, and perhaps our research to contribute to environmental objectives. We live this way despite contrary evidence—as suggested by the discussions of spiritual and scientific progress above. Scientists continue to have faith that their work will contribute, even if citation indexes show that most papers are rarely (if ever) cited and that citation rates decay exponentially. Regardless of the specifics, we strive to live this way, as opposed to living without purpose,

directionless. We want our lives to matter. And this experience of purpose contributes to our sense of progress through the metaphoric web.

Purpose and progress connect with one another through a critical cognitive metaphor in Western culture, *A Purposeful Life Is a Journey*. If a purposeful life is a journey, then we are all travelers, the objectives we set in life are destinations, and the plans we have for reaching them are our itineraries. Just as we do when we prepare for a real journey, we need to plan carefully to meet our objectives, including ensuring that we have what we need for the journey, such as education, and anticipating problems that we must overcome. We want to make sure that we are on pace and headed in the direction we want, rather than getting lost or being behind schedule. This complex metaphor underlies much of how we approach the world and our lives. Yet it is not universal. We might recollect, as Lakoff and Johnson cautioned, that "there are cultures around the world in which this metaphor does not exist; in those cultures people just live their lives, and the very idea of being without direction or missing the boat, of being held back or getting bogged down in life, would make no sense."³⁶ This perspective might help us understand how dramatically the metaphoric web of progress affects how we live our lives

Nonetheless, it seems unlikely that we will abandon progressive metaphors anytime soon, but we do have flexibility in giving precedence to one form versus another, whether financial gain, altruistic pursuit of knowledge, or spiritual growth. Yet for any of these human expressions to endure, socioecological sustainability needs to be our fundamental criterion. In particular, in the current context, how might the metaphors we choose within science bring us more in line with sustainability progress? We have to expand the bounds of scientific progress

to include a broader sense of socioecological sustainability. Such a view of progress may ask deeper questions about how to weigh scientific advances versus regressions.

Consider in more detail the case of personification in science. Its importance struck me one spring day when my three-year-old daughter and I were riding our bikes and observing the lives of creatures around us. I pointed to a pair of crows sitting near each other on a power line: "Look at that crow walking over to the other one. What are they doing?" She responded, "Are they going to fight?" That might be an expected question from a child who plays lots of video games, but we had no television. It shows how deeply an antagonistic form of personification has penetrated our culture, including children's perceptions of the natural world.

Personification is of course a form of metaphor, specifically a metaphor with which we conceptualize something that is not a person in terms of personhood, such as thinking of genes as selfish or animals as competitive. Classically, science attempts to reduce personification, as it taints the object of study with human attributes. As Ludwig von Bertalanffy, a biologist and a founder of systems theory, explained, "An essential characteristic of science [is] that it progressively de-anthropomorphizes, that is, progressively eliminates those traits which are due to specifically human experience." The origin of this tendency is not too difficult to find. Lorraine Daston, a historian and the director of the Max Planck Institute for the History of Science in Berlin, has contended that "like us, seventeenth-century natural philosophers condemned anthropomorphism not only as an intellectual but also as a moral error: failure to recognize that nature was the other was not simply wrong, but dangerously wrong."³⁷ In this sense it brought Judeo-Christian values into science rather than removing them. Regardless, it followed

that science had to lessen personification over time if it was to progress.

Some scholars, however, maintain that personification is almost unavoidable in biology. We might dismiss the agency attributed to the Oxford biologist Richard Dawkins's selfish genes, but agency appears to remain even in the proposed alternative conceptions. As another example, evolutionary biologists have removed blatant teleology from their field by using natural selection and other mechanisms to explain evolutionary change. Darwin's writing itself was very anthropomorphic, introducing the idea of natural selection through an analogy with artificial selection, yet even "the newer twentieth-century explications of natural selection that have accompanied the rise of mathematical, experimental, and ecological population genetics have not displaced the older figurative and rhetorical life of the term."³⁸ For example, who is the selector? Even common conceptions that natural selection "molds" and "shapes" continue this anthropomorphic tendency. We may find these associations with personification disgruntling, but they are unavoidable because we perceive the world from the perspective of embodied human beings.

We thus might expect that evolutionary biologists have a contradictory relationship with purpose. Although they strongly disagreed in the survey that evolution has an aim or purpose, for example, they embrace it in another arena. Consider Pigliucci's statement that "having teeth structured in a certain way makes it easier for a tiger to procure its prey and therefore to survive and reproduce—the only 'goals' of every living being." As the philosopher Ernst Cassirer has pointed out, evolutionary biology thereby elevates purpose, in the form of survival value, to the primary consideration in our study of life: "All other questions retreat into the background before this

one.” There appears to be an interesting inconsistency here, but even if evolutionary biologists do reject purpose, they cannot base this decision on scientific inquiry, which, having excluded human purpose from the universe through objectification, can only draw the circular conclusion that there is no purpose. Its rejection is an assumption, and one that relies on a firm line between humans and the rest of nature, despite Darwin’s dismissal of this metaphysical stance. Scientific evidence lends little input because we cannot even characterize life or consciousness, our most certain experiences, other than as patterns or as what their absence looks like.³⁹

Not all evolutionary biologists have rejected the idea that the purpose we experience is something that pervades existence. Consider Wright’s monistic panpsychism, the belief that life and consciousness occur to some degree in all matter. He wrote: “Emergence of mind from no mind at all is sheer magic. We conclude that the evolution of mind must have been coextensive with the evolution of the body. Moreover, mind must already have been there when life arose and indeed must be a universal aspect of existence—still assuming that mind cannot arise from nothing.” Darwin also contemplated panpsychism in his struggle over the place of consciousness in the natural world.⁴⁰ Because we have evolved from the natural world, it is possible that what we experience as purpose is something that all of creation senses (in varied ways).

A similar view may underlie the evolutionaries’ universal progress. Whereas I questioned earlier whether spiritual progress necessarily leads to sustainability, one could counter that the evolutionaries are more in touch with a purpose-laden universe. They were much more likely to believe that “nature is spiritual or sacred.”⁴¹ In this respect, the evolutionaries appear to believe that the purpose we experience is something that imbues existence.

Anthropologists have shown that many cultures around the world personify the natural world. Frans de Waal, a primatologist at Emory University, took this as an opportunity to remove the “tinted glasses through which [scientists] stare into nature’s mirror” by comparing our view with that of other cultures. He reviewed how Western primatologists perceived great apes in accord with their cultural biases: as independent individuals who lacked coherent social groupings. In contrast, Japanese scientists interpreted them through the lens of their society, as part of stable groups, a view that we now take for granted. He quoted a Japanese primatologist, Junichiro Itani, who observed, “Japanese culture does not emphasize the difference between people and animals and so is relatively free from the spell of anti-anthropomorphism.” Again, we might have expected evolutionary theory to have dispensed with the idea that humans and animals are qualitatively distinct.⁴²

Although we may now recognize the connection between ourselves and the great apes, many cultures extend this much further. For example, the social anthropologist Tim Ingold of the University of Aberdeen demonstrated that the Ojibwa draw a less firm distinction between themselves and other organisms than we normally do: “Persons, in the Ojibwa world, can take a great variety of forms, of which the human is just one.” This provides an entrée for a more significant challenge by metaphors on the literal-figurative distinction. As Ingold elsewhere explained: “To posit a ‘metaphorical’ equivalence between goose and man is not, then, to render ‘one kind of thing in terms of another,’ as Western—including Western anthropological—convention would have it. A more promising perspective is [to argue] that metaphor should be apprehended as a way of drawing attention to real relational unities rather than of figuratively papering over dualities. Metaphor . . . ‘reveals, not the “thisness of a that”

but rather that “this *is* that.”⁴³ That is, perhaps scientists’ wish to discredit personification in order to be objective artificially separates them (and us) from the natural world, when we would all benefit from breaking down such distinctions, instead emphasizing our connections with other organisms. Personification might help us understand other organisms as being like ourselves, perhaps helping us develop greater empathy with other species rather than treating them as unequivocal others.

Personification may help us better relate to the world. As Stephen Trombulak, a biologist at Middlebury College, remarked, “That creatures with an innate sense of passion for life should attempt to completely suppress this passion in an attempt to be completely objective is the real lurking inconsistency [in conservation biology].” Perhaps we need to be more passionate and engaged in the interests of conservation. The philosopher Paul Feyerabend generalized this when he claimed that scientists’ ideas and actions “can be as destructive as those of their more brutal contemporaries.” He noted, “Science certainly is not the only source of reliable ontological information,” and then argued, “It was the technological and social success of science that separated purpose and matter, destroyed animism, and turned people into addicts [for its products].” He also wondered whether more of the ancient animism might “create a greater harmony between human enterprises and nature,” thereby lessening our environmental impacts. The environmental studies scholar Neil Evernden was even more adamant about the need for environmental thinkers to accept personification, which has been called the pathetic fallacy (though he considers it a fallacy only to the “ego-clencher”), and to stimulate a resurgence of animism.⁴⁴ The environment is part of us, so the world is animate. Perhaps a fundamental limitation of modern science, and a crippling factor for develop-

ing a more encompassing environmental ethic, is that it delimits us from the natural world.

Personification urges us to revisit how the metaphors we have adopted exist among other possibilities, some of which Western culture might disallow. Some of our metaphors are entrenched and associated with normal science, a paradigmatic way of looking and thinking. Let me offer a prime example: mechanism. We commonly understand life as a mechanism, and biologists often seek mechanistic (and reductionistic) explanations in their research practices.⁴⁵ Most scientists, including ecologists, prefer mechanism to personification. Few would deny the benefits of thinking of biological systems—whether ecological or medical—as mechanisms, because it has contributed to many conceptual breakthroughs. However, this way of thinking can also be misleading. The technical metaphor of “ecological assembly,” for example, might give the impression that we can figure out how ecosystems are constructed just by knowing more about their parts and how they fit together. This might lead us to devalue existing ecosystems if we think we can replace them with reconstructed versions. Although philosophers and biologists debate the various merits and costs of mechanistic explanations, we may overlook how mechanism too is a metaphor, one that may impede our ability to comprehend life and its processes in other ways.

Furthermore, is it not strange that we are more comfortable with mechanomorphism, understanding the world through machine metaphors, than anthropomorphism? The biologist and futurist Elisabet Sahtouris reasoned, “Mechanics is an invention of just one species, man or *anthropos*. . . . and so the mechanomorphism required of us was really a kind of secondhand anthropomorphism. . . . Was nature at large not likely to be more like us naturally evolved creatures than like

our machines?" The prevalence of machine terminology reflects our modern industrialist world, but the resultant deanimation and desensitization disconnect us from our environment and even ourselves. The Berkeley historian Carolyn Merchant has demonstrated that the mechanistic worldview, led by Francis Bacon's scientific method, contributed to the "death" of nature because the living, feminine Earth had to be subdued to uncover her secrets (the habit of personifying her not having disappeared).⁴⁶

If we assume that the world is mechanistic, we may find supportive results, but that does not mean that the world *is* mechanistic. Yet we may nonetheless begin to see organisms *as* mechanisms. We have seen the brutal implications of such association in how the Nazis conceived Jews as "machine people" on account of their thought and individuality, in contrast to the holistic science and unifying Gestalt of the Germans. In a similar way, the transition in ecology from thinking of communities as organisms to thinking of them as systems of energetic feedback loops gave rise to a "technocratic optimism" in which influential ecologists such as H. T. Odum gave themselves a special role in planning a fully engineered society.⁴⁷ If such conceptions cause people to treat other beings like mechanistic machines, then I contend that they are inadequate to the task at hand—and that personifying might be preferable. If our metaphors do not encourage us to maintain a world in which we can live, what is the point of understanding for understanding's sake?

This is not to deny potential problems with personification. For example, the environmental movement has personified whales so that moratoria extend not just to endangered species, but even to more widespread ones. Icelandic whalers, however, have built a whole way of life in small villages around whale harvests. Their view of whales is pragmatic, rather than spiritual

or romantic. The harvest is a matter of economic and cultural survival, so the whalers are offended by the fundamentalism of environmentalists and antiwhalers.⁴⁸ Although personification can be used to promote an environmental agenda, the downside, in this case at least, might be the loss of a way of life.

We can turn from this discussion of personification to seek a middle ground in thinking about progress and purpose. It may be a mistake to reject progress simply because it is anthropocentric. The English philosopher Mary Midgley has suggested that "purpose-centred thinking is woven into all our serious attempts to understand anything," but "rules have to be worked out again for its proper use."⁴⁹ In working out such rules, we do not have carte blanche to accept or reject personification, but we should consider whether sustainability progress might require one form or another in some contexts.

Overall, this chapter has demonstrated the extent to which progressive metaphors interweave science and society. We cannot think of progress in one domain without sending tremors through the web into other domains. And this concluding discussion of personification raises questions about whether environmental scientists have a responsibility to endorse metaphors that are at least consistent with sustainability rather than undermining it. We cannot maintain a faith in scientific progress, which emphasizes its epistemic contributions, without careful attention to the mixed blessings that it often provides. We might be convinced of the value of a particular metaphor, but the pertinent question for us now is whether it is progressive in a broader socioecological context. To address this question, we need to attend more carefully to the place of values in science and its metaphors. We have seen values throughout this discussion of progress, but I delve into them further in the next chapter, on competitive metaphors.

II Progress

1. Nisbet, *History of the Idea of Progress*, 4. The discussion of progress here draws from Bury, *Idea of Progress*; Wagar, *Good Tidings*; Almond, Chodorow, and Pearce, *Progress and Its Discontents*; Marx and Mazlisch, *Progress*. My emphasis on Darwin is not meant to deny the existence of extensive thought much earlier, as far back as classical times, about the connections between progress in the natural and social worlds.

2. Ruse, *Monad to Man*, 526. This connection holds regardless of Darwin's equivocation about progress. The major conundrum with the linkage of biological and cultural progress is whether we are a simple extension of other forms of life on the planet, or whether our mental capacities and culture set us apart; see, e.g., Campbell, "Biological and Social Evolution"; Fracchia and Lewontin, "Does Culture Evolve?"

3. On eugenics, see Kevles, "Eugenics"; Paul, "Darwin, Social Darwinism and Eugenics." And see Williams, *Adaptation and Natural Selection*.

4. One reviewer asked why a "constructivist" argument would rely on a survey; the answer is that it is one way of finding out about the world, and in this case it served to provide a big-picture view of the status of these metaphors. The survey followed recommended protocols, including ethics approval, pretesting, and a design that sought to minimize respondent burden and thus maximize response rate; see, e.g., Schonlau, Fricker, and Elliot, *Conducting Research Surveys*; Sills and Song, "Innovations in Survey Research." Respondents were contacted in November 2003 with a personalized introductory e-mail that provided a link to one of two randomized versions of the survey, as well as a letter of endorsement from the president of their society. After two weeks, nonrespondents were sent a reminder e-mail. For further details on the survey, including discussion of its limitations, see Larson, "Social Resonance."

5. Cronbach's alpha, a measure of the extent to which survey statements cohere as a single factor, for the seven statements about progress, was an acceptable 0.76.

6. In the discussion below, note that "evolutionary biologists" and "evolutionaries" are shorthand for "respondents from the SSE" and "respondents from the FCE," respectively. The percentages reported here do not include respondents who chose the off-scale options provided in the survey questionnaire. Note that the sample size and response rate for the SSE were much greater than those for the FCE (789 versus 41 respondents, equivalent to respective response rates of 33.4 percent and 13.1 percent). These response rates are within the range reported for previous Web and e-mail surveys, but the

nonrespondents could introduce a systemic bias that must be kept in mind. Thus, I compare the organizations mostly impressionistically rather than with statistical tests. This quantitative study also limits my ability to interpret why people responded to statements the way that they did.

7. Membership count was at the time of the survey, at which point about 80 percent of its members were North American; www.evolutionsociety.org.

8. Of respondents from the SSE, 75.9 percent strongly agreed, compared to 42.5 percent from the FCE. Members of the SSE were much less likely to strongly agree with related statements, such as "Scientific knowledge gradually converges on the truth," with which 24.6 percent strongly agreed, and "Science will eventually answer all important questions about the universe, including humans," with which only 4.7 percent strongly agreed. Thus, they did not generally harbor a strong form of scientism; see Pigliucci, *Denying Evolution*.

9. Richards, "Evolution," 105; McShea, "Metazoan Complexity and Evolution," 488. For discussion of whether "complexity" is a metaphor, see Proctor and Larson, "Ecology, Complexity, and Metaphor." For further discussion of the issues about evolutionary complexity raised here, see Raup and Sepkowski, "Mass Extinctions"; Maynard Smith, "Evolutionary Progress"; Gould, "On Replacing the Idea of Progress"; Knoll and Bambach, "Directionality in the History of Life."

10. Of respondents from the FCE, 51.2 percent strongly agreed with the statement "I believe in God," compared to 5.9 percent from the SSE; 67.4 percent versus 6.3 percent of them strongly agreed with the statement "I would generally describe myself as spiritual." There is methodological risk here of reifying the distinction between a spiritual and a scientific group, but that is not my intention. Even among evolutionary biologists there is a historical association between biological progress and religion, which has much to do with its importance within evolutionary theory for so long, as well as its recent rejection. Julian Huxley and Theodosius Dobzhansky, for example, found support for their progressivism in religion, in contrast to Williams's somewhat Manichean motivation against progress; see, e.g., Ruse, "Molecules to Men."

11. "What Is Conscious Evolution," www.evolve.org/pub/doc/evolve_what_is_ce.html, quoting partly from Banathy, *Guided Evolution of Society*; This material was no longer available in August 2010, but similar material can be found at www.barbaramarxhubbard.com/con/node/8. The FCE had about three hundred members at the time of the survey. Their worldview is further explained by Hubbard, *Conscious Evolution*. Teilhard de Chardin, *Phenomenon of Man*, proposed an "Omega Point" toward which evolutionary processes aim. This proposal was met by vehement scientific critiques; see,

e.g., Medawar, "Review of the Phenomenon of Man"; Williams, *Adaptation and Natural Selection*; Monod, *Chance and Necessity*. Unsurprisingly, his system was also rejected by the Church. On the other visionaries mentioned, see Zaehner, *Evolution in Religion*; Ruse, *Monad to Man*.

12. Of FCE respondents, 30.8 percent strongly agreed with the first statement, compared to 13.0 percent from the SSE; 8.3 percent versus 1.0 percent of them strongly agreed with the second statement. On spiritual progress, see Menaker and Menaker, *Ego in Evolution*; Maslow, *Toward a Psychology of Being*; Fowler, *Stages of Faith*; Csikszentmihalyi, *Evolving Self*. For critique, see Rosenthal, *Words and Values*.

13. Chaisson, *Cosmic Evolution*, 3. For explication of these narratives, see Swinburne and Berry, *Universe Story*; Capra, *Web of Life*; Earley, *Transforming Human Culture*; Genet, "Epic of Evolution"; Chaisson, "Ethical Evolution"; Rue, *Everybody's Story*; and for critical discussion see Toulmin, *Return to Cosmology*; Csikszentmihalyi, "Mythic Potential of Evolution." Universal progress is in part a derivative of the nebular hypothesis of the eighteenth century.

14. Genetic drift is a random process whereby gene frequencies in a population may change solely because of sampling effects. Of FCE respondents, 45.9 percent disagreed or strongly disagreed with this statement, compared to 26.6 percent from the SSE. 30.8 percent of respondents from the FCE strongly agreed with the statement "Evolutionary change requires intelligent design," compared to 1.2 percent from the SSE. And 36.6 percent versus 0.4 percent of them strongly agreed with the statement "Evolution has an aim or purpose." The extent to which they would discriminate between "design" as a general issue and its particular instantiation as a new-fangled creationist movement, intelligent design, was not addressed by the survey.

15. The etymology of metaphor is complex, and the meaning here is a simplified adaptation from Webster's *Third New International Dictionary*. Metaphor is also linked to the Greek terms *epiphora* and *phora*, which highlight the "transference" or 'locomotion' of meanings across terms"; Baake, *Metaphor and Knowledge*, 62. For more on the view of metaphor presented here, see Bono, "Science, Discourse, and Literature"; Maasen and Weingart, "Metaphors—Messengers of Meaning"; Maasen, Mendelsohn, and Weingart, *Biology as Society, Society as Biology*.

16. See, e.g., Maasen and Weingart, "Metaphors—Messengers of Meaning"; Rozzi, "Reciprocal Links."

17. Williams, *Keywords*, 244.

18. I encountered the metaphor of adaptive radiation in this context in Collins and Kephart, "Science as News," 39. On evolutionary ecology, see note 17 in chapter 1.

19. Harrington, "Metaphoric Connections," 359–360. Her use of the

term *literal* reveals how easily even critics can be taken in by their metaphors. On the benefits of thinking of a web of life, see Marshall, *Nature's Web*.

20. See, e.g., Weingart and Maasen, "Order of Meaning." For a critique of systems thinking, see Berman, "Shadow Side of Systems Theory." For an introduction to the many applications of network thinking in ecology and evolution, see Proulx, Promislow, and Phillips, "Network Thinking in Ecology."

21. Star and Griesemer, "Institutional Ecology, 'Translations' and Boundary Objects," 393. On metaphors as boundary objects, see Välijärvi, "Biodiversity and the Power of Metaphor."

22. For the Templeton Foundation, see www.templeton.org.

23. Chaisson, *Cosmic Evolution*, 11. See also Kauffman, *Origins of Order*.

24. See, e.g., www.millenniumassessment.org/en/index.aspx.

25. Gibson, *Sustainability Assessment*, 46.

26. Nisbet, *History of the Idea of Progress*, 8.

27. Shanahan, "Evolutionary Progress?" 452.

28. Ruse, "Evolution and Progress."

29. For further discussion of this imagery, see Gould, *Wonderful Life*; Bowler, *Life's Splendid Drama*; Beer, *Darwin's Plots*.

30. See note 11 to this chapter. Also see Csikszentmihalyi, *Evolving Self*; Earley, *Transforming Human Culture*; Hubbard, *Conscious Evolution*; Banathy, *Guided Evolution of Society*; Csikszentmihalyi, "Mythic Potential of Evolution."

31. Gould, *Ever Since Darwin*, 37–38. Of FCE respondents, 32.4 percent agreed or strongly agreed with this statement compared to 4.6 percent from the SSE. Note, however, that 49 percent of them disagreed or strongly disagreed with it.

32. Pigliucci, *Denying Evolution*, 119, 130.

33. Kuhn, *Structure of Scientific Revolutions*, 170–173.

34. On the disunity of sciences, see Dupré, *Disorder of Things*; Feyerabend, "Quantum Theory and Our View of the World"; Galison and Stump, *Disunity of Science*; Cartwright, *Dappled World*. On the risk of applying science beyond its limits, see Berry, *Life Is a Miracle*. On career risks of interdisciplinarity, see Rhoten and Parker, "Risks and Rewards."

35. See www.icpsr.umich.edu.

36. Lakoff and Johnson, *Philosophy in the Flesh*, 63. The discussion here follows theirs, which may be consulted for further details.

37. Von Bertalanffy, "Essay on the Relativity of Categories," 258; Daston, "How Nature Became the Other," 39–40.

38. Hodge, "Natural Selection," 219. On personification in alternative conceptions of genes, see Hayles, "Desiring Agency." On personification in natural selection, see Young, "Darwin's Metaphor"; Taylor, "Natural Selection:

A Heavy Hand"; Oyama, *Evolution's Eye*. On Darwin's writing, see Young, "Darwin's Metaphor and the Philosophy of Science." For further discussion by science studies scholars of personification in a variety of biological fields, see Young, "Darwinism Is Social"; Midgley, *Science as Salvation*; Schiebinger, *Nature's Body*; Daston, "How Nature Became the Other."

39. Pigliucci, "Design Yes, Intelligent No," 38; Cassirer quoted in Ho and Fox, *Evolutionary Processes and Metaphors*, 3. On consciousness, see Schumacher, *Guide for the Perplexed*; Wallace, *Taboo of Subjectivity*.

40. Wright, "Panpsychism and Science," 82. On Darwin's panpsychism, see Smith, "Charles Darwin."

41. Of FCE respondents, 57.5 percent strongly agreed with this statement, compared to 7.3 percent from the SSE.

42. De Waal, "Reading Nature's Tea Leaves," 66, 70. On Japanese primatology, see also Asquith, "Japanese Science and Western Hegemonies." On evolution and our relation with other organisms, see Singer, *Darwinian Left*.

43. Ingold, *Perception of the Environment*, 91, 50.

44. Trombulak, "Misunderstanding Neo-Darwinism," 1203; Feyerabend, *Conquest of Abundance*, 5–8, 145; Evernden, "Beyond Ecology," 101. See also Smith, "Metaphorical Basis of Selfhood."

45. On the tension between constitutive mechanist and organicist metaphors in the history of ecology, see Mitman, "From the Population to Society"; Taylor, "Technocratic Optimism"; Boucher, "Newtonian Ecology and Beyond"; Ulanowicz, "Life after Newton."

46. Harman and Sahtouris, *Biology Revisioned*, 12. On the death of nature, see Merchant, *Death of Nature*. Also see Abram, "Mechanical and the Organic"; Berman, *Reenchantment of the World*.

47. On machine people, see Harrington, "Metaphoric Connections." And see Taylor, "Technocratic Optimism."

48. Einarsson, "All Animals Are Equal but Some Are Cetaceans."

49. Midgley, *Science as Salvation*, 9, 67.

III

Competitive Facts and Capitalist Values

1. Weingart, "Struggle for Existence," 130. On the view of competition presented here, also see Young, *Darwin's Metaphor: Nature's Place in Victorian Culture*; Young, "Darwinism Is Social"; McIntosh, "Competition." Note, however, that the romanticist idea of nature as harmonious was by no means uniform; see, e.g., Merchant, *Death of Nature*.

2. Hodge, "Natural Selection," 217; see also Paul, "Fitness." On the rela-

tion between natural selection and struggle, see Keller, "Competition: Current Usages"; Taylor, "Natural Selection: A Heavy Hand"; Rozzi, "Reciprocal Links"; Allchin, "More Fitting Analogy." The links between Darwinism per se and social Darwinism are complex and certainly not directly causal. Many historians have pointed out that Darwinism could be (and was) interpreted as support for an array of social policies, not just competitive and militaristic ones. For a discussion, see Rogers, "Darwinism and Social Darwinism"; Crook, *Darwinism, War and History*; Bowler, "Social Metaphors in Evolutionary Biology"; Weingart, "Struggle for Existence"; Caudill, *Darwinian Myths*; Hawkins, *Social Darwinism*; Paul, "Darwin, Social Darwinism and Eugenics." Some historians have even argued that Darwin himself was a social Darwinist; see, e.g., Moore, "Socializing Darwinism." For more on the applicability of Darwinian theory to social thought, see, among many others, Rose, *Darwin's Spectre*; Singer, *Darwinian Left*.

3. See, e.g., Merchant, "Radical Ecology." On the link between progress and competition, also see Goatly, *Washing the Brain*.

4. Some scholars would consider the derivation of what "ought to be" from what "is" an instance of what G. C. Moore dubbed the naturalistic fallacy; see, e.g., Wilson, Deitrich, and Clark, "On the Inappropriate Use of the Naturalistic Fallacy." Such concerns are more precisely attributable to Hume, however; the fallacy is applicable instead to the attempt to derive ethical properties from natural properties. Thus, I will not discuss the naturalistic fallacy here, even though it has been discussed extensively in the context of evolutionary thought; see, e.g., Farber, *Temptations of Evolutionary Ethics*; Maienschein and Ruse, *Biology and the Foundation of Ethics*; Rosenberg, *Darwinism in Philosophy*. For further discussion of the relation between is and ought in environmental metaphors, see Fleming, "Can Nature (Legitimately) Be Our Guide?"

5. Wilson, Deitrich, and Clark, "On the Inappropriate Use of the Naturalistic Fallacy," 671. On rape, see Zuk, "Feminism and the Study of Animal Behavior"; Dupré, "Fact and Value."

6. See, e.g., Solomon et al., *Climate Change 2007*, 5.

7. Dupré, "Fact and Value," 31. Though the distinction between facts and values is useful, its reification causes problems; see, e.g., Putnam, *Collapse of the Fact/Value Dichotomy*; Dupré, "Fact and Value." For further discussion of values in science, see below, and Shrader-Frechette and McCoy, "How the Tail Wags the Dog"; Proctor, "Expanding the Scope of Science and Ethics"; Kincaid, Dupré, and Wylie, "Value-Free Science?"; Douglas, *Science, Policy, and the Value-Free Ideal*. For climate change science specifically, see Demeritt, "Prospects for Constructivist Critique"; Pielke, *Honest Broker*.

8. For discussion and further examples, see Williams, *Ethics and the*