



A More Fitting Analogy

How does one aptly characterize natural selection?

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In our culture no one needs a biology class to learn about “survival of the fittest.” Yet one might need instruction to unlearn the misconceptions engendered by the analogy’s potent imagery.

Does “survival of the fittest” describe organic evolution or human culture? The ambiguity fosters unwarranted impressions in both contexts. In biology, misleading social metaphors distort understanding of natural selection. Meanwhile, in society, competitive ideology is unduly naturalized (or improperly inscribed in “nature”).

Thus, in popular perspectives, humans—however civilized—are brutish organisms vying for jobs, status and power. Maybe they also compete reproductively for prime mates. The language resonates with “survivor” contests on television: “Outwit. Outplay. Outlast.” Physical “fitness” and athletic prowess become ideals. A human’s fate seems to be life *versus* death, fit *versus* unfit, winning *versus* losing. Cooperation and coexistence give way to warfare, conflict and backstabbing gossip: “culture, red in tooth and claw,” to adapt Tennyson’s phrase. Mostly, life reduces to *competition*. Cutthroat competition. Through the survival-of-the-fittest expression, all these interpretations seem to have a biological basis. It is not an idle definition of natural selection.

Remedying these confusions involves, foremost, carefully distinguishing the domains of organic evolution and culture (*Sacred Bovines*, Jan., 2007). Students also need to be aware of the naturalizing error: how cultural values may illegitimately shape scientific conceptions of nature (last month’s essay). Still, problems may persist due to the very language itself. The connotations of the phrase seem inescapable. Here, I consider the misconceptions latent in the very terms themselves: ‘survival’ and ‘fit’—as well as the ‘-est’ suffix. That may help us craft a more fitting analogy or catchphrase.

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Surviving

Consider first the import of the word ‘survival’. On a population level, differential survival leads to differential reproduction, the essence of organic selection. Darwin talked of “proportional numbers” (1859, p. 81). Yet when one thinks in terms of individuals (as individual students often do), the outcome seems to reduce to survival or death. Fit organisms live, unfit ones die. In the “struggle for existence,” one either succeeds or fails. Selection becomes *either-or*.

In this way biologists perhaps unwittingly help perpetuate a culture that tends to acknowledge only winners and losers, survivors and also-rans. The language of crude “survival” subverts the biological lesson, as well as fostering inappropriate cultural overtones. Shifting from a world of stark black-and-white to a world of nuanced grays is, of course, an important part of maturing intellectually. Teaching natural selection ideally is an occasion to promote that lesson, rather than reinforce simplistic preconceptions. Lab activities or presentations that highlight “black-and-white” predation may thus foster misleading impressions (Allchin, 2001).

Darwin called natural selection a “principle of preservation”: the “preservation of favourable variations” (1859, pp. 127, 81). He referred to “the strong principle of inheritance” and how “any selected variety will tend to propagate its new and modified form” (p. 5). Darwin thereby underscored the importance of continuity and propagation as integral to selection.

A focus on survival, by contrast, lessens the significance of reproduction, successive generations, and the long-term. Death seems to merely weed out the unfit. Selection seems to act negatively, as a screen, or filter. Selection becomes *eliminative*.

This image, too, is echoed in our culture, even in how we elect to entertain ourselves. In television game shows, “survivor” contests, beauty pageants and talent searches, contestants are successively eliminated. They are often pared down one by one. In sports—from softball to drag racing to tennis—one frequently finds *double elimination* tournaments. Athletic championships are often decided not by overall season performance, but through stepwise

reduction in end-of-season play. Why do we choose to enjoy ourselves this way? Why do all use an eliminative framework?

With a primary focus on survival and elimination, it is hard to appreciate how natural selection can be creative, or generative. A focus on reproduction, by contrast, underscores the iterative process. Fitter variants proliferate. Adaptive organisms flourish. Selection leads to expansion, even without reduction. Favorable traits, once preserved, can accumulate. New forms can emerge. Highlighting amplification instead of elimination changes the whole image of the process. Creation replaces destruction. Diversification replaces extinction. Growth and development replace death. One might characterize natural selection more positively, then, as differential *amplification*: “the fecundity of the fittest,” or “the flourishing of the fit.”

Being Fit

Consider next how students commonly perceive fitness, or being “fit.” In nineteenth-century England, fitness already had a non-biological meaning: appropriateness, or “answering the purpose.” Today still we might say “an event fit for the occasion” or “a fitting analogy.” —Like well fitting gloves or jeans? Darwin’s contemporaries would have easily understood the new biological meaning: an organism as well suited to its natural environment. Darwin invited his readers to note:

how infinitely complex and close-fitting are the mutual relations of all organic beings to each other and to their physical conditions of life (1859, p. 80).

Organisms adapt to something. Natural selection occurs with respect to a local environment. Fitness develops meaning only in context.

Since Darwin’s time, the meaning of fitness outside biology has shifted. One significant development (especially in America) was the physical fitness movement and the introduction of physical education into schools. Now, athletics permeate school culture and designer fashions, business networking, perceptions of college prestige and international Olympic stature. Sports earn their own section in daily newspapers and exclusive channels on television. Our culture today regards fitness primarily as *physical* fitness. —And how esteemed it is! Advantage seems to depend on being stronger, fleeter, hardier, more agile. Selection seems primarily *athletic*.

Darwin himself referred to the “struggle for existence” and the “battle for life,” sometimes even drawing on militaristic metaphors (such as defense, shields, attacks, or the “war” of nature). Yet such expressions were also balanced by other images. For example, after describing the swiftest and slimmest wolves as best able to capture prey, Darwin discussed nectar-laden flowers as best able to attract insect pollinators. Nectar-gathering insects, likewise, benefitted from “curvature or length of the proboscis” (1859, pp. 90-95). Darwin’s finches, of course, provide a classic example, modestly based on foraging, not fighting. Fitness is based on functional context. The challenge for teachers is to use examples that students cannot reinterpret as physical contests for individual survival. Ideally, one frames fitness in terms of efficient foraging or resource use, say, rather than athletic ability.

Athletic images of fitness also further confound understanding of the reproductive dimension of natural selection and sexual selection. Of course, one may easily succumb to a caricature of athletes flexing muscles for sexual stature among prospective

mates. Darwin himself described how cocks used their spurs in competing for females. Yet he subsequently cited examples “of a more peaceful character”: birds that secured mates by being “the most melodious or beautiful” (pp. 88-89). How different natural selection seems when exemplified by warblers, orioles, toucans or birds of paradise, rather than lions and tigers and bears! In *Descent of Man*, Darwin described at length the role of gaudy plumage, insect calls, and showy antlers in attracting mates. Other traits enhance reproductive success, as well, such as large-yolked eggs, internal fertilization, internal development, nesting, and feeding and teaching offspring. Is it beyond our ability to make the generation and nurturing of offspring as dramatic or apparently compelling as the athletic competition of the World Series or NASCAR racing?

Fortunately for biology teachers, an opportunity for teaching basic natural selection lies close at hand. All the essential concepts are exhibited in how our bodies respond to infection. First, a repertoire of specific immune cells provides *blind variation*. Second, an antigen provides the “environment.” *Fit* immunoglobulins are those that literally “fit” the antigen. Variant and environment are complementary. Consequently, the well adapted cells *proliferate*. The potential to recognize the pathogen is *amplified*. Clonal selection is thus a valuable tool for teaching the mechanism of natural selection without engaging all the cultural imagery (and politics) of evolution.

A biological focus on resources and preservation, rather than athletic or militaristic traits, begins to indicate an alternative characterization. A modern echo of the old term “fit” would be “apt.” How fortunate, perhaps, that “apt” is the very root of adaptation and adapted.

Being the “-Est”

Consider, finally, what at first may hardly seem worth the notice: the “-est” in “fittest.” The superlative suffix, far from being insignificant, accentuates the comparison between organisms. “Fit” alone no longer suffices. One must be *more* fit. Selection becomes fundamentally *competitive*. One must also be more fit than any other. One must be the *most* fit. Selection becomes *winner-take-all*. With such apparently high stakes, no wonder perhaps that selection also seems primarily *antagonistic*.

Competition surely featured in Darwin’s own conception of natural selection. Darwin, like many others at the time, saw nature as luxuriant and full. New species, he imagined, would have to “wedge” their way in among those already filling available habitats and using available resources (1859, pp. 67, 110). Darwin also applied a Malthusian perspective about society to biology: scarcities would lead to a “struggle for existence.” Indeed, Victorian culture viewed both culture and nature as fundamentally harsh. Envision Charles Dickens’ London: poverty, slums, child labor and grim working conditions. Part of Darwin’s triumph was to conceive how even from Malthusian-like conditions in nature, adaptive design might nevertheless develop. “From the war of nature, from famine and death,” he rhapsodized in his conclusion, “. . . endless forms most beautiful and most wonderful have been, and are being, evolved” (p. 490). Darwin adopted, yet also grandly transformed the competitive views of his culture.

Our culture is not Darwin’s. Yet competitive rhetoric still reigns. For example, nations, cities and businesses strive for “economic competitiveness”: an abstract ability to compete seems to upstage the goal of ultimate economic sustainability

or well being. Once, an economy was a system for exchanging goods and services; now, it's seen as market forces. Once, education was a forum for knowledge and understanding; now it's about being able to "compete" for jobs. (In the short-term, of course, it's all about competing for grades and admission to the best schools.) Even recreation frequently drifts into competitive games, as though we could not entertain ourselves without winners and losers. Cheerleading, once about rallying competitive spirit among others, is now competitive itself. Somehow, the culture succumbs to Spencerian doctrines that unfettered contests lead to a better world (last month's essay). Would such competitive frameworks be so pervasive if the "survival of the fittest" language did not implicitly render them as "natural" and progressive?

Moreover, social competition is often winner-take-all—reflected in a widely parroted creed that "*only the fittest survive.*" How many seem to care about second best, whether in the Super Bowl or American Idol? Even democratic governance seems reduced to "winning" just enough support to simply eclipse the "opposition." Elections, too, seem less systems of collective discourse and choice, than mud-slinging competitions for votes. Winning and excluding seem more important than developing a community-wide consensus. Challenge these norms and you typically get an incredulous earful of mangled natural selection concepts blindly applied to social contexts. The very fabric of American society—from economy and governance to education and recreation—seems permeated with the "survival of the fittest" theme of winner-take-all competition.

Natural selection may surely be propelled at times by competition. Yet selection also occurs widely without it. For example, the first organisms to venture on land flourished more by escaping competition than by "beating" it. Entering new adaptive zones, proliferating and diversifying is a familiar evolutionary theme. Indeed, that would be the story of the first finch from the South American mainland to reach the untapped Galapagos archipelago. Selection can reflect capitalizing on opportunity. In other cases, organisms adapt by tolerating "stressful" habitats—low in water, nutrients, light or other vital resources, or at extreme temperatures, pH, etc. (Postgate, 1994; Gross, 1996). In yet other cases, in frequently disrupted environments, organisms adapt by "being ahead of the competition." They exploit the potential to reproduce and disperse rapidly, rather than compete directly. Life strategies vary widely. Competition for limited resources is not the only pattern.

One may also want to remedy the perception of selection as crudely selfish, and hence antagonistic. Many organisms thrive through cooperation. Mutualisms abound. Pollination and seed dispersal symbioses are widely known, but perhaps too often relegated to the shadows. Another remarkable set of mutualisms in the news recently involves sea slugs (Pennisi, 2006). As unshelled mollusks, sea slugs are soft, vulnerable and move, well, "at a snail's pace." They are quintessentially unathletic. Yet by hosting algae or chloroplasts in their digestive glands, some can survive for months without food. In this case, selection has amplified cooperative abilities. Sociality can evolve, too. Mutualisms may be intraspecific, as well. Ironically, the presence of cooperative behavior hardly seems to stem the common competitive mindset. That may bear witness to the potency of the "survival of the fittest" metaphor.

An Alternative Darwinian Gestalt

In summary, in our culture, the phrase "survival of the fittest" is misleading biologically, while lending ghastly inappropriate support to many social metaphors. Biology teachers should abandon this popular definition (another sacred bovine?). They should explicitly expose its pretensions.

But let us not pretend that we can proceed without an alternative sound-bite. We need a succinct, memorable substitute. We need a catchphrase that does not frame selection as inherently: (1) eliminative, (2) athletic, or (3) antagonistic. Selection is not and need not be framed as: (4) either-or, winner-take-all competition. Instead, an ideal alternative will highlight: (1) the role of reproduction and the flourishing of lineages, (2) context and local resources, (3) multiple potential life strategies, and (4) opportunism. While we're at it, why not find something a little less severe? Without romanticizing nature, can we portray a brighter, more genial Darwinism?

Perhaps we might take a cue from Darwin himself. In closing the *Origin of Species*, he invoked the image of "an entangled bank, clothed with many plants of many kinds, with birds singing on the bushes, with various insects flitting about, and with worms crawling through the damp earth" (1859, p. 489). He found "grandeur in this view of life": rich, diverse and fertile. The image echoed thoughts Darwin recorded decades earlier in his private notebooks, where he drew ostensibly the first evolutionary tree. Some lineages expand. They diversify. As in living trees, when one branch dies, other branches grow and fill the opportune gap. The core image is: flourishing.—And organisms flourish because they aptly fit their context. Hence, they generate, as Darwin penned so eloquently, "elaborately constructed forms, so different from each other, and dependent on each other in so complex a manner" (p. 489).

Here, then, is a prospective alternative: *amplification of the adapted*. That is:

We may call the principle, by which variant organisms well suited to their environment are preserved and flourish, Natural Selection, or Amplification of the Adapted.

That may not be perfect. Another expression may improve on it. Should anyone find a "more fitting" one, let us all know: sacred.bovines@nabt.org. We'll spread the word. —Or do we need a prize competition?

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