

Chapter 4

We have seen that in large sparse regions fiercely competitive and cooperative organisms will predominate; that these organisms have an inborn ability to compete even murderously, and that this ability is less likely to be found in lush places. Inspection now reveals other genetically-disposed abilities that separate geographically in a predictable fashion.

Demonstrated Ability is Actual Ability

An organism species that exists in a circumstance for a time demonstrates the ability to exist in that circumstance for that time. A species that does not exist in a circumstance for a time does not demonstrate the ability to exist in that circumstance for that time. The first organism type *must* have the ability to survive its circumstance or it would not survive there. The second organism type only *may* have the ability to survive a circumstance it has never known. What *must* be so has a probability of one (“ $p=1$ ”), whereas what only *may* be so has a probability of less than one (“ $p<1$ ”) because it includes the possibility that it is not so. (More generally, $P(A|D) > P(A|\neg D)$, where A =”The organism has the ability,” and D =”The organism demonstrates the ability.”)

When we say an organism has a particular ability we mean that we expect that the organism can accomplish a particular feat in the future. Ability is intrinsically an expectation. **To have a lower probability of having the capacity to do a thing is exactly to have less ability to do that thing.** It follows that an organism variety that has not demonstrated the ability to survive a circumstance *in fact has less actual ability* to survive the circumstance than a variety that has demonstrated the ability to survive the circumstance.

One common circumstance faced by organisms is *movement* relative to Earth’s surface. Such movement played a central role in the Sparse Box thought experiment because it was limited movement that made a box of an organism’s habitat. Moving about in itself entails ability of course, even if it is only the ability to go with a flow. However, moving entails other abilities as well, and it is these that interest us here. Three questions draw attention to these other abilities.

1) *Travelers*: Which organism type demonstrates more ability to survive in a wider range of environments, and experiences more phenomena new to the other – one that stays in a small area or one that travels about in a large area including the small area? The question is rhetorical because the answer is obvious, particularly for organisms on land: In general, organism types that move widely survive in a wider range of environments than organisms that live within the wide-mover’s range but move about much less. Far-flung environments *not* experienced by the more sedentary are *new* to them. The wide-movers thus demonstrate the greater ability to survive variety and novelty. Hence by the reasoning above, **widely-moving organisms have more actual ability to survive**

environmental variations and novelty than do more sedentary organisms within the wide-movers' range.

2) *Pioneers*: Which organism type demonstrates more ability to survive in an environment previously uninhabitable by that organism's general kind, the pioneering type that first migrates into and survives in the new environment or the home-stayers left behind? Again the answer is obvious. Pioneering organisms that first survive in a previously uninhabitable frontier demonstrate, and therefore have, greater ability to do so relative to home-stayers. Relative to home-stayers, **pioneering organisms have greater ability to face the novel challenges of unexplored frontiers.**

3) *Loners*: Which organism type demonstrates more ability to survive unaided in a world of physical objects and alien species – a type whose individuals spend a large fraction of their time moving about far from others of their kind or a type whose individuals spend most of their time near close relatives? An organism's self-sustaining causal loops first pass through whatever is nearby, and in the case of solitary organisms most of what is nearby are physical objects and alien species. An organism type whose individuals have spent a relatively large fraction of their time far from their kind – i.e. **a wide-ranging loner type – demonstrates and therefore has relatively great object-related ability** that depends relatively little on relatives or on social ability. Even members of a frontier team are likely to spend time individually away from others, and in any case have no larger society to depend on, compared to less adventurous crowd-dwellers.

In the last chapter we found that the tendency to murderous competition varies geographically. In this chapter we have found new differences that also vary geographically. Specifically, organisms in sparser outer regions of a population are more mobile, more able to survive environmental variety and novelty, and more adept at using physical objects unaided in the service of competitive survival than are cousins in more population- and resource-dense central regions.

How deep are these inevitable differences? Are they genetic, hence slow to change, or learned and so reversible in a generation? This raises the hoary nature/nurture question: "Can't the differing organisms all be basically the same by nature and the mobile organisms simply *learn* to survive in a wilderness?" The general answer is *no, inner and outer organisms cannot be intrinsically the same*, for the following reason: As anyone who tries to teach a rock soon discovers, **learning itself takes ability.** An organism that learns to survive in a new wilderness demonstrates the ability to *learn* how to survive in a new wilderness. An organism that remains in familiar territory does not demonstrate the ability to learn how to survive in a new wilderness. An organism demonstrably able to learn therefore is not the same as one that does not demonstrate such ability.

In general how do we know when an ability is genetic, that it is inborn and strongly depends on genes? We know when the need for the ability is *vital* – i.e. life is impossible without it – and the need is *immediate* – there is no time to learn the ability. Given that swift death is the penalty for inability when confronting great environmental variety and novelty, particularly at a previously uninhabitable frontier, it is essentially certain that the

ability to survive in a greatly varied or previously uninhabitable environment depends strongly on genes and gene combinations. Furthermore, these genes and gene combinations are likely to be rarer among home-stayers because the home-stayers do not suffer death for lacking them: The relevant genes among the home-stayers are diluted by genes that wouldn't survive the variety and novelty of wide movement or migration into a frontier but do survive at home.

One can attempt to resurrect the nurture-only view of organism ability by proposing that the ability to learn is itself learned. Learning study habits is in a sense learning the ability to learn, for example. However, the result is quickly an infinite regress of learning to learn to learn and so on. **At some point the learning depends on the inborn ability of an organism and that is most demonstrated by the outward-migrating organisms.**

These considerations about demonstrated, genome-based ability lead to the following:

Demonstrated Ability Predictions: An offspring of a wandering and pioneering variety of organism is more likely to survive in the habitat of more sedentary cousins than an offspring of the sedentary cousins is to survive in the frontier, regardless of whether the two are raised in their type's native habitat or in the others' habitat. When competing for resources, the offspring of the mobile pioneers are more likely than the offspring of sedentary types to make effective use of physical objects.

The two linked predictions already have the form of tests and predicted results. If on average, and given similar early environmental exposures, an offspring of mobile-pioneer stock does not thrive and use physical objects at frontiers, more than an offspring of home-stayer stock in similar circumstances, then the prediction is falsified.

We are now in a position to combine the predictions of this and the last chapter. Both chapters predict that the abilities of organisms moving about near and migrating into frontiers will differ on average from those of geographically separate home-staying cousins. This correlation of predictions is no accident: It can be traced to the properties expected of everyday objects, *before* they are observed – the properties of the *A Priori Object* – and how these constrain organism evolution. I detail this connection in this chapter's [planned] appendix. For now it suffices that –

Relative to more sedentary cousins, individual organisms pioneering sparse outlying frontiers are genetically more inclined to be murderously competitive, to form tight cooperative bonds in teams, to survive environmental novelty, and to make effective and independent use of physical objects in the service of competitive survival.

This aggregation of abilities does not mean that mobile pioneers win every battle for resources. Non-pioneers have significant abilities of their own.

Home-Stayer Abilities

Mobile pioneers do not have a monopoly on ability. Relatively sedentary, more crowd-dwelling organisms demonstrate two abilities that mobile pioneers and loners do not, abilities that tend to balance power between more- and less-mobile types and that are of crucial importance to the long-term survival of a species:

- 1) The ability to co-exist in large groups with others of their kind without killing them
- 2) The ability to exist in groups large and stable enough to sustain high-information-capacity social (and computational) networks. In a crowd causal chains and loops have ample opportunity to pass through many neighbors and their artifacts.

Note that the Demonstrated Ability prediction refers to individuals surviving in habitats, not in *societies*. The complementarity of abilities between more sociable sedentary types and more solitary mobile types confers an advantage to a species that maintains genetic continuity between, and forms hybrids of, the two. We pursue this very important subject later.

Exceptions, Objections, and Confounds

By now the reader will have accumulated objections to the reasoning thus far. In an effort to guide the reader quickly through a forest without crashing into trees I have presented arguments in bare, if I hope rigorous, outline. I have systematically excised all distractions from the main line of argument. For this reason I have made no catalogue of objections and rejoinders to this point. It happens that many objections fade upon closer inspection – for example exceptions that end up proving a rule, or corrections that leave a conclusion standing – but a few objections do not fade quickly. I now list some of the more refractory among these in order to guide the move from general to specific in the next chapter. Here then are a few objections, with commentary:

Ability Loss: How can mobile organisms be said to have more ability to survive environmental variety and novelty if they no longer return to their sedentary ancestral range? To illustrate, if the legs of ancient hippopotami gradually changed (became “repurposed”) to fins of whales then the whales thereby *lost* the ability to walk on land. Here the adaptive inertia described in Chapter 2 comes into play. If a mobile organism migrates outward over many fewer generations than its ancestors were sedentary (i.e. it *accelerates* outward) then it retains a strong genetic “memory” of sedentary conditions and so simultaneously demonstrates the ability to survive in new environments and keeps some ability to survive in its sedentary ancestral range. Of course, an organism that moves widely throughout the full range of its species does more certainly demonstrate a wide range of abilities. Note that even a whale, far removed from a hippopotamus, exhibits some adaptive inertia of this kind: Although it cannot walk on land, a whale can survive a trip far up a river longer than a hippopotamus can survive far out at sea. I have personally met a whale that survived such a river journey.

Probability magnitude: This chapter’s reasoning about demonstrated ability tells that the probability of having an ability is greater when it is demonstrated, but it does not say *how*

much greater. In principle the probability difference could be only a tiny fraction of a percent! This is one of the places where what people want to see is likely to color what they do see. Absent further advance in theory the only way to gauge the actual probability difference is through assiduously controlled observation and experiment. If possible, it may help to quantify confounding physical traits (or their underlying genes) and to compare the abilities of sedentary and mobile cousins with similar confounding traits.

Context-dependence: How can one distinguish between 1) distinct mobile and sedentary organism types and 2) a single organism type with the context-dependent ability to switch between mobile and sedentary behaviors? The latter appears to falsify a prediction when in fact it does not really test the prediction. One need distinguish the two possibilities only if a prediction appears to be falsified, and in that case scrutiny of organism ancestral histories is called for – with an eye out for superficially dissimilar organisms whose ancestors have spent similar times in sedentary and mobile, or crowded and sparse, conditions.

Sociable pioneers: Not all pioneers are socially independent. I think of this as “the cosmonaut problem” because a cosmonaut, while clearly a pioneer, also depends heavily on the support of others on Earth in order to survive the interplanetary frontier. Even with this social dependence, however, cosmonauts frequently demonstrate abilities that the home-bound do not. The aborted Apollo 13 moon voyage is a case in point: However great the support from Ground Control, without the unusual abilities of the pioneering space crew – abilities no ground-based handholding could replace or assist – all aboard would have perished.

Even at this chapter’s level of generality it is possible to get lost in the trees. The main points are simply that organisms have abilities, that demonstrated abilities are more likely to exist than abilities not demonstrated, that particular abilities are expected of migratory outliers, and that these are very likely to be genetically determined.

We are now ready to proceed from general to specific.

