

CULTURAL SOFTWARE

A THEORY OF IDEOLOGY

J. M. B A L K I N



Yale University Press *New Haven & London*

Published with assistance from the Louis Stern Memorial Fund.

Copyright © 1998 by Yale University.

All rights reserved.

This book may not be reproduced, in whole or in part, including illustrations, in any form (beyond that copying permitted by Sections 107 and 108 of the U.S. Copyright Law and except by reviewers for the public press), without written permission from the publishers.

Set in Janson Roman by Rainsford Type, Danbury, Connecticut.

Printed in the United States of America

Library of Congress Cataloging-in-Publication Data

Balkin, J. M.

Cultural software : a theory of ideology / J.M. Balkin.

p. cm.

Includes bibliographical references (p.) and index.

ISBN 0-300-07288-0 (cloth : alk. paper)

ISBN 0-300-08450-1 (pbk. : alk. paper)

1. Ideology. 2. Culture. 3. Social values. 4. Justice.

I. Title.

B823.3.B25 1998

140—dc21

97-37011

A catalogue record for this book is available from the British Library.

The paper in this book meets the guidelines for permanence and durability of the Committee on Production Guidelines for Book Longevity of the Council on Library Resources.

10 9 8 7 6 5 4 3 2

Cultural Software
J. M. Balkin
Yale University Press 1998
Online version

With the permission of Yale University Press, the author has made an online version of this book available under a Creative Commons Noncommercial Sharealike (by nc sa) license, accessible at the author's website at <http://www.balkin.com>.

I have compared cultural software to a toolmaking tool. Yet to grasp the full meaning of this comparison we must understand the word *tool* in its broadest possible sense. The tools of understanding that I call cultural software are different from hammers and nails. Hammers and nails are made by human beings but are physically separate from them. I can pick up a hammer or put it down. I can carry it with me or leave it at home. Not so with the tools of understanding. The tools of understanding work by becoming part of my apparatus of understanding, which is to say they work by becoming part of me. Cultural software is not just something that we use to understand and evaluate the world; it is also part of us. Indeed, human beings do not become persons until they enter into culture and become imbued with some form of cultural software. To exist as a person is to exist as a person who has cultural software, who *is*, in part, her cultural software.¹

There is an old anthropological view of humanity as *homo faber*, Man the Toolmaker. It argues that human beings are distinctive because they fashion tools for their own use. Its paradigmatic conception of human activity is technical, and its paradigmatic vision of human reasoning is instrumental. This conception is too narrow to provide a just account of the human condition.² It focuses on the acquisition of technical skills rather than on the social skills that are central to our existence as cultural beings. Yet the limitations of the *homo faber* thesis stem not so much from its view that human beings fashion tools but from its limited conception of what tools are. And for many people the idea of tools does not go much beyond this narrow conception. Because the metaphor of the tool is central to my argument, it is important to attack this conception and show its limitations.

What Is a Cultural Tool?

The narrow conception of tools that I find objectionable rests upon four implicit assumptions which at first seem almost definitional: First, a tool is a material object that is physically separable from the person who wields it. It can be taken up or discarded at will. Second, a tool is designed for a particular purpose and has a specific function. Third, the tool's use is purely instrumental—to further a preexisting end specified by its user. A tool is, quite literally, an instrument, and hence a pure adjunct of instrumental rationality. Fourth, using a tool involves a purely technical skill.

At first, these four assumptions seem perfectly natural and even necessary, especially if our paradigmatic examples of tools are hammers, knives, and clay pots. Yet hammers, knives, and pots were not the only tools that humankind developed. People also developed language and other social skills. Once we recognize language as the quintessential cultural tool, each of the previous four assumptions must be jettisoned. First, our linguistic abilities cannot be separated from us. They are part of who we are. Second, these abilities are not designed for any one purpose. We use language for any number of purposes. Indeed, we use language to formulate new purposes for which language will subsequently be used. Third, our use of language is not purely instrumental; we use language to express our values and interact with others. Finally, our use of language is not a purely technical skill; it is the social skill *par excellence*.

The tools of understanding that I am primarily interested in fall into this latter category. They are internal to and inseparable from human existence. They prominently include social as well as technical skills. They are not necessarily designed for a single purpose but have multiple purposes and are often the source of new purposes. They are not simply means to an end but the means of developing and articulating our ends.

In fact, once we recognize language, and not the clay pot, as the paradigmatic cultural tool, we begin to realize that even material objects like hammers and pots do not fit the limited conception of tools that I have associated with *homo faber*. Material tools do not have to be designed for or serve a single purpose, for example. Lévi-Strauss pointed out that much human activity is like the work of a bricoleur, or odd-job man, who takes whatever implements lie to hand and uses them for new and unintended purposes.

Second, even if material objects are separable from our physical self, they can be important and constitutive parts of our social self. Hegel pointed out that our social identity is strongly linked to our possessions, the ways we use them, and the opportunities they make available to us. As King Lear discovered, to abandon one's property is simultaneously to radically change one's social relationships. The person who surrenders her glasses, her telephone, her car,

and her computer changes not only her instrumental abilities but also her social life. The destitute and the homeless may lack certain instrumentalities, but the losses they feel are not purely instrumental ones.

Third, people use their intelligence to create tools, but these tools simultaneously endow their users with new kinds of intelligence, because they allow users to experience and interact with the world in new ways.³ The tool changes the horizons of our imagination, opens up new perspectives, and makes new kinds of considerations possible. The tool does not simply change our ability to experience the world; it also changes the world we experience.

Tools change our imaginative horizons because the world now appears as a possible object of manipulation in new ways. Yet tools also change our perspectives because they help create a world centered around their use and the products of their use. Tools like computers, looms, and printing presses also give rise to new concepts, new skills, and new concerns. They not only make it possible to analyze the world in new ways, but they also become objects in the world around which new social skills, social institutions, and artistic practices can be organized. Thus the development of the hammer makes possible the development of skills involving a hammer, like forging iron. The invention of the automobile gives rise to the possibility of magazines, clubs, and institutions organized around the manufacture, racing, display, and general admiration of cars. The development of musical instruments gives rise to the possibility of organizations like symphony orchestras, professions like conducting, and eventually, to the rise of a music industry, schools of performance, and the practice of music criticism. Computers make possible computer-assisted graphics and design, electronic churches and chatlines, and books like this one, whose central metaphor compares cultural know-how to computer software.

Finally, tools are not always mere adjuncts of instrumental rationality. They are used in many different ways. In particular, I want to distinguish three different uses of cultural tools. The first is to get about the world, to understand and make use of it. The second is to interact with other people, and the third is to express and articulate human values.

In practice these purposes surely overlap. I distinguish them analytically because I want to contest the natural association of tools and toolmaking with the first purpose, and in particular, with instrumental rationality. The slide from *instrument* to *instrumental* is easy to make; too often we think of tools solely as a way of exploring and mastering the natural world. This mastery can be either material or intellectual—it may occur either through controlling and shaping nature or through understanding it. Nevertheless, if this were the only point of toolmaking, the conception of culture as a set of tools, and the conception of humankind as a toolmaker and tool user, would be significantly

impoverished. Human culture would be thoroughly instrumental, nothing more than a means by which human beings master their environment. Such a conception of culture would fail to recognize the existence of other human beings; or, in the alternative, it would view them as just another set of objects to be controlled, governed, studied, and mastered. Similarly, the concept of reason developed through culture would be reduced to instrumental rationality. People would not be able to reason about values or ends but only about means.

We may justly criticize a culture to the extent to which it is primarily or excessively concerned with instrumental rationality at the expense of other forms of reason. Such a view forms the basis of Horkheimer and Adorno's critique of the Enlightenment.⁴ Nevertheless, we should not confuse this criticism with a criticism of the metaphor of toolmaking or with the conception of human beings as toolmakers. That criticism is valid only if toolmaking really has no other purpose than the mastery of objects. The tendency to think that this is so may itself be a symptom of living in a culture that has placed too high an emphasis on instrumental concerns and instrumental rationality.

A second and quite different purpose for making and using cultural tools specifically concerns our relationships with others. Culture and cultural tools enable us to treat other individuals as persons and to negotiate (and struggle over) shared meanings with them. Language is perhaps the best example of this sort of tool. This use of cultural tools presupposes the existence of other minds that are recognized as others, rather than merely as objects of control. The ideas of negotiation and struggle require other thinking beings with whom to cooperate or contend. This recognition is as true of cooperative ventures as it is of competition and even war. We have a relationship with an enemy, because an enemy is another person against whom one struggles, rather than merely an object or a force to be mastered or dominated.⁵ Thus all forms of human conflict, including war, have both instrumental and intersubjective features.

An important feature of cultural toolmaking, then, is to share with, negotiate with, and struggle with others as others. We use cultural tools to communicate with others, play with others, care for others, work with others, and fight with others. Much of our technology involves devices for interpersonal interaction, cooperation, and struggle; examples include telephones, baseball gloves, bedpans, mascara, and machine guns. The very word *discourse* that has emerged as a substitute for the concept of ideology implies an intersubjective connection between ourselves and others. *Discourse* comes from Latin words meaning to run back and forth. It implies a bidirectional movement between parties rather than a unidirectional control of an object by an intelligence. In the same way, *conversation* comes from a Latin word meaning to turn around—also implying a notion of reciprocity.

There is some irony, therefore, in Michel Foucault's adoption of *discours*

to explain cultural power. He writes, for example, of the emergence of “a discourse in which the sexual conduct of the population was taken both as an object of analysis and as a target of intervention.”⁶ Here discourse becomes a technology of governance over a population, a way of normalizing, shaping, and controlling people’s behavior. Often Foucault even speaks of individuals in terms of bodies that must be directed and controlled through discourse as well as technology. Thus, for Foucault, *discours* often has a strongly instrumental flavor, although it is by no means clear in his writings who, if anyone, is wielding the instrument.

The normative bite of Foucault’s analysis of discourse stems precisely from the way in which discourse controls people and their bodies, objectifies them, and denies their freedom—in other words, precisely from the ways in which discourse is false to the idea of communicative reciprocity. On the other hand, sometimes Foucault seems to speak as if it were appropriate to analyze selves as merely the products of discourse, and the objects of control by discourse (as well as technology). This subverts the normative uptake of his analysis. I argue instead that to the extent that culture merely makes people into objects of control, it can justly be criticized for transforming all cultural tools into instrumental tools and all persons into objects of control or governance. Indeed, as I shall argue more fully in Chapter 12, if culture is not understood in terms of its intersubjective aspects, it is difficult to account for struggle and resistance, because individuals become simply the intersections of larger forces of discourse and technologies of bodily control as opposed to situated agents who employ cultural tools in their struggles.

Nevertheless, it is important to recognize that the intersubjective aspect of culture, like the instrumental, is by no means uniformly benign. If language is a tool used to cooperate with others, it is also one of many tools that human beings use to struggle with and dominate others. Our distinction between the instrumental and the intersubjective aspects of culture is not a distinction between the harmful and the beneficial uses of culture; within each perspective the tools of culture can be employed for good or for ill.

Cultural Software and the Articulation of Values

A third use of culture and the tools of culture is the articulation and expression of human values. Human beings have values, and these values are one of the most important features of human life. Or more correctly, human beings value, for we should think of *value* primarily as a verb, not a noun. Values are not so much what people have as what they do and feel. Human beings possess an inexhaustible drive to evaluate, to pronounce what is good and bad, beautiful and ugly, advantageous and disadvantageous. Without culture, human values

are inchoate and indeterminate; through culture they become differentiated, articulated, and refined.

Consider the example of music. Before culture there are no electric guitars, violins, or orchestras. There is no art of orchestration, no sonata-allegro form, no idea of jazz or the blues. There is only the human delight in producing and listening to interesting and beautiful sounds. Throughout human history people develop different ways of making and organizing sounds, which they test against their developing sense of beauty and interest. Their sense of the beautiful and the interesting in turn is developed through exposure to and use of the cultural tools available to them within their culture. So a person who lives in Austria in Mozart's time has a certain sense of taste about what is delightful and interesting in music. Her values are articulated in a certain way, although in another culture and another time they might be articulated differently.

The word *articulate* comes from the Latin *articulus*, meaning organized in joints or joined. It carries the double meaning of dividing something up into distinct parts (hence a person is articulate who can make distinct sounds) and joining parts together (for example, the articles of a larger document, like the Articles of Confederation, an early form of government for the United States). Thus articulation involves both distinction and construction; it consists in both the refinement of old values and the creation of new values from old ones.

Both refinement and construction are involved in the cultural articulation of musical tastes. People develop their tastes by becoming able to make distinctions between different pieces of music or different performances of music. If we have never heard jazz before, we may have only a vague idea of what we like and dislike. We may not be able to distinguish Coleman Hawkins from John Coltrane, or Thelonious Monk from McCoy Tyner; in addition, our sense of what is enjoyable and what is tedious may be limited or inchoate. After we hear more jazz, two things may happen. First, we become accustomed to jazz and we may come to enjoy compositions we would not have previously enjoyed. Second, we become increasingly able to distinguish between different performances of jazz and can express our judgments with greater distinction and refinement. The notion of refinement involves both the alteration of our tastes through exposure and familiarity (like the development of a taste for wine) and the ability to recognize distinctions in what previously seemed an undifferentiated whole. Hence we say that a person's taste is refined precisely when she is able to make distinctions, separating out the better from the worse.

Yet cultural articulation also involves construction. Culture does not merely enable us to make increasingly finer distinctions; it also enables us to create new possibilities for musical enjoyment and musical evaluation by creating new types of instruments, new forms of musical expression, and new musical compositions. These cultural constructions are passed on and modified from gen-

eration to generation. They become part of our developing sense of musical taste and enable us in turn to make new evaluative distinctions, distinctions that were not previously possible because they partly presuppose cultural constructions that had not yet come into being. In this way culture continually creates new tools for musical evaluation and expression.

Like our aesthetic sense, our ethical sense is also articulated through culture, though the terms of this articulation are by no means identical in all respects. Broadly construed, our ethical sense concerns how we should live our lives, as well as the evaluation of what is praiseworthy and what is deserving of scorn. An example of this articulation is the historical proliferation of virtues and vices. By this I do not mean that people become more virtuous or wicked by living in culture. I mean that through culture we come to divide up simpler notions like *good* and *bad* into a kaleidoscope of varieties and modes of virtue and vice. Through culture we come to understand many different varieties of good human character and activity, including wisdom, mercy, friendliness, loyalty, courage, and justice. At the same time, we come to recognize and distinguish many different bad aspects, including snobbishness, hostility, indifference, sloppiness, conceitedness, avarice, and aggressiveness.

Just as there is a proliferation of evaluations of human character and moral activity, there is a proliferation of good and bad human qualities that are not virtues or vices (for example, being impoverished or honored), good and bad features of human institutions, and good or bad features of inanimate objects. Indeed, a large part of human language is devoted to evaluative concepts that articulate, refine, and subdivide the inchoate ideas of the good and the bad. Through culture people articulate their evaluative sense into different conceptions like good and evil, pious and impious, advantageous and disadvantageous, fortunate and unfortunate, healthy and unhealthy, beautiful and ugly, sublime and mundane, noble and base. These categories, in turn, are further divided, constructed, refined, reconceptualized, and replaced. Hence, from more simple, indeterminate, and inchoate human values culture constructs a complex, rich, and detailed language of human evaluation.

Like the articulation of musical tastes, the articulation of human virtues and vices occurs within a cultural and historical context and hence develops and changes with that context. Compare, for example, the treatment of artificiality and naturalness between the eighteenth and nineteenth centuries. In the Age of Reason, artificiality is a virtue; it illustrates the application of human intelligence to a situation. In the Romantic age, artificiality is viewed as a vice, and naturalness, lack of pretension, and spontaneity (all identified in one way or another with authenticity) are exalted as virtues. In this way each age and culture articulates various features of the human condition that are worthy of praise or blame.

By this example I do not mean to suggest that every act or every trait that is virtuous in one era or place will necessarily be viewed as harmful or wicked in another, or that there is no common ground between cultures and times. Rather, differences in associations may occur because a culture places a different emphasis on traits and behaviors, in part because of the history and cultural context bequeathed to them.

Moreover, because evaluative terms are articulated through cultural development, some evaluative concepts come into being or gain greater importance at certain points in history, while others become less important, are largely forgotten, or even fade away. Thus the idea of being neurotic, obsessive, or compulsive is largely a concern of our own time, while speaking of people as being temperate or intemperate is a less common way of thinking about and evaluating them, though it was quite important in an earlier age.⁷

As in the case of our aesthetic sense, the articulation of our ethical sense involves not only distinction but also construction. Some virtues and vices are internal to particular practices that arise only at particular points in human history. Thus one cannot have the vice of being a promise breaker until there is a practice of promising; one cannot have the virtue of being creditworthy until there are financial institutions that bestow credit.

Culture also enables human beings to express their values through construction and exemplification in concrete institutions, practices, and behaviors. Take, for example, the value of justice. This value is inchoate and indeterminate. In order to give meaning to it in our lives, we must exemplify it in institutions, rules, or a system of law. Not only is this construction necessary to achieve justice, it also provides us with necessary tools and examples for further reasoning about what is just and unjust. The importance of concrete exemplification to theoretical development is likely to be overlooked. In the *Republic* and the *Laws*, Plato tried to define justice. But he discovered that in order to explain his vision, he had to construct an imaginary state, complete with institutions, social classes, occupations, offices, and regulations. The same is true in the world outside philosophical speculation. We concretize our indeterminate value of justice by creating human institutions and practices that attempt to enforce it and exemplify it, even (and especially) if we recognize that all of these institutions are imperfectly just. Of course, because justice is an indeterminate standard, there is no necessary way to exemplify it. The value of justice does not tell us, for example, whether a democratic legislature should have one, two, or three houses. Hence the institutions that people construct to exemplify justice may be different in different eras and different lands.⁸

It follows from the same line of reasoning that human beings can also generate ever new examples of injustice and oppression through their cultural

constructions. In different times and places, human beings find new ways to work evils on their fellow creatures, and to create monuments to brutality and repulsiveness. Thus, when I say that culture allows us to refine and articulate our values, I do not mean that culture necessarily makes us better people or leads unequivocally to what is good. Moreover, when I say that people use culture to exemplify their values through constructing practices and institutions, I do not mean that whatever standards a culture produces define what is good and bad, or that it is not possible to criticize a culture for producing wicked practices or unjust institutions. I endorse neither a claim of progressive betterment through culture nor a claim of pervasive moral relativism. Rather, I am arguing that people use culture as a kind of tool to express their values and to put flesh on the bones of their inchoate urges by constructing concrete examples of what they value. Of course, like all tools, these cultural tools can be used well or ill, skillfully or awkwardly, and what they generate can be well or ill produced. If we think that culture can develop or refine our tastes, we must concede that it may also debauch or coarsen them.

Bricolage and the Creation of Cultural Software

Cultural software consists of collectively created tools that constitute us as persons and that we use to make new tools for understanding the world around us, interacting with others, and expressing our values. Yet one cannot make something out of nothing. The tools that we create must be constructed out of those we already possess. We must make all our new cultural tools out of our old ones: this is as true of our cultural software as it is of our technology and our institutions.

The history of thought is the history of the cumulative marshaling of existing capacities to form new ones, the use of older cultural software to create newer “idea-programs.” This process of cumulative construction of new conceptual tools out of old ones resembles Claude Lévi-Strauss’s notion of *bricolage*. Lévi-Strauss argued that human thought operates like the bricoleur, or odd-job person, who fixes a leak or other problem with whatever tools lie to hand.⁹ My use of *bricolage* differs in an important way. An odd-job person repairs leaky faucets and roofs that remain with the customer after the repairman moves on; the bricoleur repairs them with tools that are distinct from the roof and the leaky faucet. In my conception of bricolage, what the bricoleur creates in her jerry-built fashion she keeps with her to use in the next job, and the next. The products of earlier bricolage become the new forms and methods of later bricolage.

The claim that culture, and in particular cultural software, is the result of

bricolage entails four basic notions. Cultural bricolage (1) is cumulative, (2) involves unintended uses, (3) is economical or recursive, and (4) has unintended consequences. Let us consider each of these features in turn.

First, cultural bricolage is cumulative. The tools of understanding that one can create at a particular time depend largely on the available materials that lie to hand. The complexity and performance of a tool are necessarily limited by the nature of the tools available to construct it. Consider the examples of a spacecraft and a mutual fund. A spacecraft requires the development of sophisticated forms of metallurgy, the production of powerful chemical fuels, and the construction of elaborate electronic systems for computation and communication. The construction of the Apollo spacecraft that traveled to the moon in 1969 was not just the result of a huge investment in engineering skill during the 1960s but also depended on centuries of innovation that made the final stages of technological development possible.

A mutual fund is a device for lowering the risk of investing in bonds, securities, and other financial instruments. Yet in order to create such a fund, elaborate financial institutions already have to be in place, which, in turn, could only be developed after the creation of previous financial institutions. The capitalist “free market” involves much more than simply allowing people to buy and sell commodities, as the reformers in Eastern Europe discovered soon after the fall of communism in 1989. It requires elaborate institutional mechanisms for amassing and distributing capital, spreading financial risk, and developing new instruments for capital investment, institutions that required centuries of experimentation and development.

Just as human beings engage in cumulative development of technology and institutions, they engage in cumulative development of their cultural software. Through this development increasingly rich and varied modes of thought become available to human beings. Conversely, the ability of human beings to articulate new ways of thinking depends upon the cultural inheritance bequeathed to them and upon the tools of understanding available at a particular point in their history. This development is often nonlinear and unpredictable; developments in one area of culture may hold the key to changes in a completely unrelated area. Cultural development is the unanticipated use of the unexpected, passing under the name of rational progress.

A second feature of cultural bricolage results from the first. Because the bricoleur uses whatever tools lie to hand, she does not necessarily employ tools for their original purpose. She may employ a screwdriver as a makeshift hammer, or use a bucket as a doorstop. Thus, central to the concept of bricolage is the possibility of unintended use. By this I do not mean that tools are not used intentionally by agents but rather that they are put to purposes for which they were not originally intended. Like other tools, human institutions may

also be adapted to new purposes originally unintended. The organization of the family, for example, can be employed by analogy to organize a religious movement, and the features of religious organizations may be adapted to political or social organization. Democratic political concepts, in turn, can be grafted onto the structures of religious organizations. The mechanism of a market can be applied in countless ways. In this fashion human institutions solve problems of organization, reproduction, and stabilization by adopting and adapting features of other social structures that their members are familiar with. In this way new forms of human sociability are constructed out of older ones.

Cultural software is also the product of unintended usage of previous concepts. People use familiar concepts in order to describe the world and construct new concepts. Wittgenstein explained the nature of language and thought, for example, by comparing it to a game. Once this is done the notion of a “language game” takes on a meaning of its own and can be used metaphorically or analogically by later thinkers.¹⁰ This book is itself an exercise in conceptual bricolage, for it borrows from several disciplines in order to construct its argument.

Many examples of previous conceptual bricolage can be discovered through the study of etymology. For example, I noted earlier that the word *articulate* comes from the Latin *articulus*, meaning joined or jointed. If we pursue this etymology further, we discover that *articulus* and *ars* (art) have a common ancestor. The concept of art may originally have developed from the idea of joining or assembling something. Both of these words, in turn, probably share a common ancestry with the English word *arm*. Indeed, it is possible that *articulus* and *ars* are metaphorical extensions of an ancient word for arm. The arm is the most obvious example of something that is joined to the body and that itself contains joints. In this way words that are used for one purpose are extended to serve new purposes. Thus from *ars* we get *artist*, *artisan*, *artful*, and *artless*, and from *articulus* we get not only *articulate* (to divide sounds, hence having the ability to do so, hence eloquent) and *article* (a division of words, hence both a grammatical form and a type of writing) but also *arthritis* (a condition of the joints). Human language often develops new concepts by metaphorical, metonymic, or analogical extensions of older concepts; these concepts, in turn, may be employed to develop still newer ones that bear only the remotest relationship to their ancestors.¹¹ In this manner language moves from the concept of an arm to the idea of eloquence.

A third feature of cultural bricolage is its economy: a relatively small number of tools are used in many different situations to do a comparatively large number of jobs. The social theorist Pierre Bourdieu has used the expression “economy of logic” to describe this phenomenon.¹² Bourdieu points out that cultures can use a relatively small set of conceptual oppositions repeatedly to

generate increasingly complex sets of cultural meanings. Gender is a good example of this process. In many cultures, including our own, the concepts of male and female are assigned not only to human bodies but to many types of concepts and objects. First, there are familiar associations regarding men and women. In our culture, for example, there are stereotypes involving colors (blue and pink), tools (hammers and brooms), food (steaks and salads), and literature (adventure and romance). Second, in various cultures, objects and concepts may be called male or female—for example, Father Time and Mother Nature. Inanimate objects may be labeled male or female because of analogical comparisons to male or female anatomy (male or female phone jacks) or to stereotypical “male” or “female” traits under patriarchal ideology (the moon as the lesser light, the reflection of the sun). Third, and most important, gender categories may be assigned simply for purposes of conceptual bookkeeping and division. Examples are languages that divide all nouns into male, female, or neutral genders. Grammatical assignments of gender are a good example of the cumulative nature of bricolage, for often these assignments have only a very indirect relationship to historical male and female stereotypes. More often they have none at all; it is simply necessary as a matter of linguistic convention that everything be assigned a gender. In this way the grammatical use of the term *gender* comes to have an entirely new meaning.

The cumulative use of gender categories in diverse situations for a vast variety of purposes thus results in ubiquitous male and female encodings in language, thought, and practice.¹³ Yet this is not the result of deliberate design. It is rather the result of the repetitive use of simple tools to fashion newer tools, all of which bear the marks of the previous tools used to make them, and each of which transmits this marking to the tools that it in turn is used to make. Conceptual bricolage is a repetitive and recursive semiosis or meaning making. It is repetitive because it is used in many different contexts and for many different purposes; it is recursive because it is applied to results of previous conceptual bricolage. Because conceptual bricolage is repetitive and recursive, there is an important connection between the economy of bricolage and the phenomenon of unintended usage. The conceptual bricoleur uses concepts, distinctions, and frameworks repeatedly in new situations; this virtually guarantees that these concepts, distinctions, and frameworks will be employed in contexts and for purposes for which they were not originally designed.

A fourth feature of bricolage results from the previous three features. The bricoleur’s economical and cumulative use of tools in unintended ways can and often does lead to unexpected and unintended consequences both for good and for ill. This is perhaps the single most important idea in the philosophy of culture—the unexpected consequences of human thought and action. It rightly plays a central role in many philosophies of history and culture. Vico’s idea of

Providence, Kant's conception of Nature in the history of human development, Hegel's notion of the "cunning of history," and Marx's claim that men make history, but not as they intend it, all exemplify this insight. The concept of cultural bricolage is yet another way of approaching this difficult but fundamental idea in the philosophy of culture.

The unintended effects of cultural bricolage can be both positive and negative. In fact, they tend to be both positive and negative at the same time. They have simultaneous unexpected and unplanned benefits and disadvantages. We can better understand this phenomenon through an analogy to another form of development, biological evolution.

Cultural Bricolage as a Form of Evolution

The idea that cultures evolve is, if anything, older than the idea that species evolve.¹⁴ The rise of Darwinian theory made it natural to see possible analogies between cultural and biological evolution, and various attempts have been made to do so from Darwin's time to the present day. Such analogies, however, can be misleading unless one notes the grounds of difference as well as similarity. We might begin by distinguishing between Darwinian and Lamarckian theories of evolution. Lamarckian evolution argues that organisms survive by adapting to their environment and passing on their acquired characteristics to their offspring; Darwinian evolution argues that organisms that have relatively adaptive characteristics are more likely to survive and pass their genes on to their offspring. A Lamarckian would argue that giraffes' necks became long because giraffes kept stretching them in order to reach high leaves on trees; a Darwinian would argue that giraffes with long necks were better able to survive in times of limited food supplies. In Lamarckian evolution, variation occurs as a response to the environment; in Darwinian evolution, variation is random and the environment weeds out the comparatively maladapted.¹⁵

Biological evolution appears to be Darwinian, employing natural selection as its central mechanism.¹⁶ Cultural evolution, however, seems to be both Darwinian and Lamarckian.¹⁷ Cultural evolution does not proceed merely through recalcitrant experience choosing among various cultures and acculturated individuals. Members of a culture can to some degree self-consciously understand the problems facing them, change aspects of their culture to face new challenges, and pass these changes in cultural software, institutions, and technology to succeeding generations.

This description of cultural evolution is not, strictly speaking, Lamarckian. Unlike the giraffes in Lamarck's theory, human beings do not pass on their acquired cultural innovations through their genetic materials; they pass them on through social learning. To say that cultural evolution is Lamarckian, we

must make two important additional assumptions. First, we must regard human beings as combinations of both their genes *and* their cultural know-how. Second, we must regard social learning as a form of nongenetic inheritance. If we make these two assumptions, cultural evolution becomes the evolution of cultural know-how transmitted through culture-carrying creatures. These creatures evolve because the cultural component of their being varies and develops over time.

Because cultural evolution involves cumulative social learning, it can proceed much more quickly than biological evolution.¹⁸ Biological evolution has taken hundreds of millions of years to produce intelligent life on this planet, while cultural evolution has taken thousands of years to bring human abilities to their present levels.

The conception of culture as a set of toolmaking tools is Lamarckian in the sense that cultural know-how can become part of people and can be passed along to succeeding generations through social learning. Nevertheless, an evolutionary theory of culture, whether Lamarckian or Darwinian, faces a significant problem. Both types of theories assume that evolution is produced by differential rates of survival for entities in a given environment. If cultural evolution is a kind of human evolutionary process, individuals or groups of individuals that adopt certain innovations would tend to have greater chances of survival in a particular environment than those that do not.¹⁹ But it is difficult to explain many aspects of cultural change in terms of their increased survival value for particular human beings or for the human species generally. Although some forms of cultural development do benefit human beings by increasing their chances for survival (for example, the development of medical science), many others do not. There is no reason to think that the proliferation of different guitar and violin designs, for example, or the successive fashions and styles of popular music or dress significantly assist the survival of the human species.

I wish to make two basic claims about the relation between conceptual bricolage and theories of evolution. First, for the reasons just stated, the process of conceptual bricolage is not, like biological evolution, a form of natural selection of human traits. The content of human cultural software is not driven by differential rates of human survival in the same way as human genes. Nevertheless, I shall argue in this chapter that there are many important analogies between the historical process of conceptual bricolage by human beings and the biological evolution of organisms, and these comparisons shed considerable light on the nature of cultural software. In drawing these analogies I am working in the opposite direction from a famous paper on evolutionary biology by Stephen Jay Gould and Richard C. Lewontin.²⁰ They used examples of cultural bricolage to elucidate the mechanisms of biological evolution. Gould and Le-

wontin harbored no illusions that the processes of cultural and biological development were identical; but they also understood that these differences did not foreclose important points of comparison.

My second major claim about culture and evolutionary theory is the subject of Chapters 3 and 4. Although the growth of cultural software is not a form of natural selection of human beings, it is a form of evolution. There is a genuine Darwinian process involved in its development. However, this process is not primarily concerned with human survival, and the unit of selection is not human genes, human beings, or groups of human beings. Instead, the unit of selection is cultural software itself, and the “environment” in which it competes, survives, and propagates is the human mind.

Analogies Between Cultural Bricolage and Biological Evolution

As I have argued, one of the most important features of conceptual bricolage is its connection to the unintended consequences of human thought and action. We can draw several analogies between the evolutionary development of organisms and the many important and powerful features of human culture that are not the product of conscious planning.

First, let us consider the question of unexpected advantages. We might begin with a distinction between designed and designoid objects.²¹ Designed objects are the result of conscious shaping and planning by some intelligence; designoid objects are objects that appear to be designed but are actually the unintended or nonintentional consequences of causal forces. An example of a designoid object would be the symmetrical pattern of a crystal, or the distribution of iron filings when they come into contact with a magnetic field. Darwinian evolution assumes that all living organisms are designoid. The human eye operates and functions as if it were designed; indeed, it operates better than any device created by human engineering. However, Darwinian evolution holds that this is the result of natural selection and other evolutionary forces as opposed to conscious planning.²²

Although much of human culture is the product of conscious design, many other aspects of culture can be described as designoid. For example, consider a market. A market sets prices for commodities, takes orders for production, and distributes goods and services. All of these tasks might be deliberately planned and performed under a command economy. But a market achieves them without the conscious design of any individual or set of individuals. Thus a market, although making use of the plans and intentions of individual agents, produces a system of production and distribution that is not designed but designoid. Indeed, advocates of *laissez-faire* argue that a designoid market performs better than a consciously designed command economy.

Just as environmental features work like a refiner's fire to produce magnificent structures that would be the envy of any designer, the cumulative development of culture through bricolage can have unexpected benefits. Nevertheless, this presents an overly one-sided view of biological evolution. Not all features of organisms, even those of very successful organisms, are perfectly arranged. Nor is every feature of an organism maximally adaptive for its present environment. Indeed, if this were the case, it would cast serious doubt on the Darwinian theory of evolution, or, for that matter, any sort of evolutionary explanation. To the contrary, the best evidence of evolutionary forces is that certain features of organisms are imperfect and poorly crafted.²³ These imperfections provide us with another analogy to the process of cultural bricolage.

The evolutionary theorist Stephen Jay Gould offers the giant panda as an example of evolutionary bricolage. The panda has a bone extending from its wrist that acts as a primitive and clumsy opposable thumb; this thumb enables it to eat its staple diet of bamboo. Compared with the human thumb, the panda's is awkward and poorly designed. This awkwardness, though, is evidence of evolutionary development. The herbivorous panda evolved from carnivores that used their digits for clawing, not grasping. The previous evolutionary development of carnivores foreclosed the development of a digit into a thumb; instead, a "thumb" developed as an extension of the wrist bone.²⁴

The panda's thumb exemplifies several important features of evolutionary explanation. Evolution makes do with the materials it is handed. What it has to work with depends upon the evolutionary problems of the past and previous responses to them. As a result, an evolutionary mechanism cannot always employ the solution that would be best if an organism were to be designed from scratch. Rather, the very awkwardness or imperfection of a solution to environmental pressures is evidence of the historical nature of evolutionary production. Organisms carry their history with them, so to speak, and this history shapes and directs the possible accommodations that an organism can make for the future.²⁵

In the same way, cultural bricolage must construct new tools of understanding out of previous ones. This shapes and constrains the way new tools are constructed. Tools are crafted to deal with the problems of a particular time and particular circumstances. They may work well enough for one set of circumstances but less well in new situations, and they may have unexpected benefits in still others. Hence there are two different sides to cultural bricolage. First, as contexts change, older tools turn out to have unexpected side effects and even deficiencies. This is analogous to the carnivore's claw that becomes less useful when placed in the new context of a herbivore's diet. Second, people may modify or adapt existing tools for purposes quite different from their original use in order to deal with new situations. This is analogous to the devel-

opment of a wrist bone to create an opposable thumb. These modified tools, in turn, will have unexpected side effects when they are placed into new contexts.

Central to the concept of cultural bricolage, then, are the simultaneous degrees of constraint and freedom produced by historical development. Although historical development always forecloses certain possibilities (in the same way that the panda's evolution from a carnivore foreclosed the development of a thumb from a digit), at the same time it also creates new possibilities for innovation (like the development of a thumb from a wrist bone). In the same way, features of existing technology, institutions, and cultural software are always potentially available for adaptation to new and unintended purposes.

Yet this freedom comes at a price. Cultural tools produced by bricolage never work perfectly: when they do work it is usually only well enough for the purpose at hand. This is as true for the predecessors of present-day cultural tools as it will be for the future products of culture. Thus the development of culture is not simply a falling away from a previous time when cultural tools were perfectly adapted to the world. There is never a time when the products of cultural bricolage lack a certain jerry-built character, when they do not have unexpected side effects or the potential for such side effects. The history of the development of culture is always the history of muddling through, with so many unexpected turns and twists along the way that "the unexpected" threatens to become the rule rather than the exception.

Existence in history produces the marks of history. Organisms produced by evolution display the remnants of previous development, which may have little relevance to the environmental problems they currently face. This accounts for so-called vestigial organs like the human little toe or appendix; the continued presence of these organs is evidence of previous evolutionary development.²⁶ Precisely because organisms do evolve, one cannot infer that because an organism currently has a certain feature, that feature is currently adaptive. Rather, one can infer only that the feature was at some point relatively adaptive or relatively advantageous (or was genetically linked to such a feature) given the particular environment in which it developed, and that it does not create such a great hindrance to the organism in its current environment as to have been eliminated through natural selection.

Indeed, if organisms are truly the products of historical development, current utility is neither a necessary nor a sufficient condition for an organism's possessing a given feature. Some existing features of an organism may have developed for another purpose but have turned out later to bring unexpected advantages to future generations. These instances of evolutionary bricolage are called exaptations.²⁷ Gould points out, for example, that "feathers work beautifully in flight, but the ancestors of birds must have developed them for an-

other purpose—probably for thermoregulation—since a few feathers on the arm of a small running reptile will not induce takeoff.”²⁸ Indeed, a particular feature may have served a series of different purposes, each leaving a mark on its development. As a result, it becomes difficult to see how the feature could have evolved directly to serve the function it now serves.²⁹

Like organisms, cultural tools bear the marks of their own history—the seams, inconsistencies, and imperfections that are evidence of bricolage.³⁰ Like certain features of organisms, the tools of understanding may lie dormant for many years until they become useful for a new and unexpected purpose. I have previously noted that the theory of cultural software is a theory of existence in history; to exist in history is to consist in part of the cultural software developed at a particular time. Here is another way of understanding the consequences of this claim: cultures, and the people composed of cultural software who live within them, also display the remnants of previous development, which are the result of problems faced previously in the past but which may bear less relevance today. We see this in the etymology of words and in traditional practices and concepts that seem to have outlived their original use. Nevertheless, aspects of culture can always be turned to new purposes in new situations. Features of culture developed for other purposes can turn out to have unexpected uses. New ideas can be developed out of older ones by metaphoric or metonymic extension; new institutional matrices can be created out of old ones employed in different situations and times. Through this process cultural tools come to bear the marks of the previous purposes for which they have been employed. Cultural bricolage wastes little, uses much, and multiplies its imperfect improvisations on imperfect cultural tools endlessly.

I have identified the imperfections of bricolage with the application or modification of older tools in new and unexpected contexts. But the problem is implicit in the very concept of a tool. No tool is perfectly adapted for all situations and all tasks. All tools, even well-designed ones, involve trade-offs that are integral to their design and performance.³¹ An automobile is very good at traveling on land for the same reasons that it is wholly inadequate for traveling on water. Although improvements in technology can produce an amphibious vehicle that travels equally well on land and water, features of its design will make it inadequate for still other purposes, for example, travel by air, production of food, or mathematical computation. Thus the usefulness of tools is always tied to the context of their use.

Like biological evolution, cultural bricolage makes do with the available tools of understanding to create new ones. It has features of both the designed and the designoid. It is the work of human intelligence but has unexpected consequences; to paraphrase Marx, people make culture, but not as they intend. For this reason, human culture does not produce technologies, institutional

frameworks, or ways of thinking about a problem that would necessarily be best if one could design them from scratch. Indeed, the cumulative nature of historical development precludes this, for the tools necessary to engage in such a design do not exist at every point in time, and whatever human beings can create at any point in time is constrained by previous technology, institutions, and cultural software already in place.

We may offer one final comparison between cultural bricolage and biological evolution. Both are nonteleological theories of change, or are agnostic about teleology. Species evolve in response to the conditions they face, the features they currently possess, and the stock of genetically transmissible variations available at a given time. There is more than one way for species to meet a given environmental problem, and different species have solved similar problems in different ways. Some paths eventually lead to a dead end because of unforeseeable changes in environment, an insufficiently flexible set of morphological features inherited from the past, or an unluckily limited set of variations available at the time when a crisis of survival arises. Moreover, those changes that do occur need not be the most adaptive or even the best from some other normative standpoint. Rather, a change must, either by itself or in combination with other traits with which it is linked, be sufficient to guarantee the survival of the species in its present competition with other species and in the context of the local environment. Biological development is thus cumulative, but it is not necessarily a cumulative improvement. Darwinian theory is a theory of evolution away from previous conditions rather than toward a particular goal. This picture does not assume that there is some goal of increasing perfection toward which species strive; it does assume that the course of this evolution is checked by recalcitrant experience in the world. Thus this sort of evolution responds to the environment without being teleological.

By analogy we might argue that the development of cultural software is also nonteleological; cultural change does not occur as the result of a conscious plan by a unitary intelligence or the working out of an inherent natural tendency in human beings. Although cultures (and the people in them) must be responsive to recalcitrant experiences, although human beings are forward-looking agents, and although certain lines of development are foreclosed by past development, cultures need not develop in a foreordained way. Instead, cultures and the people within them respond to the problems they face (problems that may involve much more than mere survival) based on the situation they find before them, their existing cultural tools, and the available sources of variation or innovation. Although cultures seem to evolve away from the past (albeit at different rates), it is quite unclear what they are evolving toward. It remains entirely possible that human beings will destroy themselves through culture, or reach cultural dead ends and blind alleys of cultural development.

nating conventions like deciding whether to drive on the left-hand side or the right-hand side of the road. *Ibid.*, 5–8. Moreover, describing conventions as solving “problems of coordination” puts altogether too rosy a glow on social conventions like slavery, or cultural associations of femininity with submissiveness. As described more fully in Chapter 3, we must try to understand how self-replicating conventions and institutions can be parasitic on the human capacity for sociability and harmful to human interests.

22. See Immanuel Kant, *Critique of Pure Reason*, unabridged ed., Norman Kemp Smith, trans. (New York: St. Martin’s, 1929), A 346–47, B 404–5.

23. See, e.g., Edmund Husserl, *Ideas: General Introduction to Pure Phenomenology*, W. R. Boyce Gibson, trans. (New York: Collier, 1931); Claude Lévi-Strauss, *The Raw and the Cooked: Introduction to a Science of Mythology*, vol. 1, John Weightman and Doreen Weightman, trans. (New York: Octagon, 1970); Noam Chomsky, *Reflections on Language* (New York: Pantheon, 1975).

24. The idea of cultural software differs from the Gadamerian notion of a tradition in yet another way: Cultural software encompasses more than linguistic ability. It includes bodily skills that, although teachable through language, are not the same thing as linguistic ability. These include the ability to cook a soufflé, play a musical instrument, or hit a baseball. Although Gadamer insists on the importance of language as the medium of tradition, his formulation fails to encompass all of the many different types of skills and bodily movements that can be transmitted and reproduced in individuals, that constitute them as individuals, and that affect their understanding of themselves and of the world.

25. A hardware/software combination of this type is sometimes called a virtual machine, because it uses the software to imitate another machine that has a different hardware configuration or is dedicated to a different set of tasks. For example, with the right kind of software, a Macintosh computer can become a “virtual” IBM-compatible computer and run some kinds of DOS-based programs.

26. For an evolutionary argument describing how the capacity to employ software might have developed in humans, see Daniel C. Dennett, *Consciousness Explained* (Boston: Little, Brown, 1991), 182–91. Dennett contends that “software” transforms the hardware of the brain into virtual machines that perform various tasks (211). He then argues that human consciousness is the product of these hardware/software interactions (218).

2. Bricolage and the Construction of Cultural Software

1. The claim that cultural software is constitutive of the person is also true, in a somewhat different way, about technology and institutions. Our subjectivity may also depend on our participation in social institutions, and it may even depend, as Hegel argued in his theory of property, on the material objects that we own.

2. The most well-known philosophical critique of the *homo faber* model is Hannah Arendt, *The Human Condition* (Chicago: University of Chicago Press, 1958).

3. Donald A. Norman, *Things That Make Us Smart: Defending Human Attributes in the Age of the Machine* (Reading, Mass.: Addison-Wesley, 1993); R. L. Gregory, *Mind in Science: A History of Explanations in Psychology and Physics* (Cambridge: Cambridge Uni-

versity Press, 1981); Daniel C. Dennett, *Darwin's Dangerous Idea: Evolution and the Meanings of Life* (New York: Simon and Schuster, 1995), 377–78.

4. See Max Horkheimer and Theodor Adorno, *Dialectic of Enlightenment*, John Cumming, trans. (New York: Continuum, 1994; orig. pub. 1944).

5. Conversely, one can critique forms of violence or war to the extent that they objectify individuals and deny them recognition as human beings.

6. Michel Foucault, *The History of Sexuality*, vol. 1, *An Introduction* (New York: Vintage, 1980), 26.

7. We find an analogous result in cross-cultural classifications. The concept of machismo that was articulated in Hispanic and Latino culture is quite different from the virtue of being a mensch among Eastern European Jews.

8. Here I follow the excellent discussion in T. K. Seung, *Intuition and Construction: The Foundation of Normative Theory* (New Haven: Yale University Press, 1993).

9. Claude Lévi-Strauss, *The Savage Mind* (Chicago: University of Chicago Press, 1966), 16–36.

10. See, e.g., Jean-François Lyotard and Jean-Loup Thébaud, *Just Gaming* (Minneapolis: University of Minnesota Press, 1985).

11. The development of the ancestral word for arm into the Latin *articulus* would be an example of metaphorical or analogical extension—from a thing to things similar to it in some respect. The development from *arm* to the homonym *arms* is an example of metonymic extension—from a thing to things associated with it. As I shall explain in more detail in Chapter 11, metaphoric and metonymic extension are important features in the construction of ideological thought.

12. Pierre Bourdieu, *The Logic of Practice* (Cambridge: Polity, 1990), 86–97; Pierre Bourdieu, *Outline of a Theory of Practice* (Cambridge: Cambridge University Press, 1977), 109–58.

13. See Bourdieu, *The Logic of Practice*, 250–70; Bourdieu, *Outline of a Theory of Practice*, 87–95.

14. Thus, long before Darwin, Immanuel Kant argued that mankind develops through a process of cultural evolution. Kant, “Idea for a Universal History from a Cosmopolitan Point of View,” in *Kant on History*, Lewis White Beck, ed. (New York: Macmillan, 1963). However, Kant’s vision of evolution, like those of his contemporaries, and unlike Darwin’s, was based on a notion of gradual progress toward enlightenment.

15. See Stephen Jay Gould, *The Panda’s Thumb: More Reflections in Natural History* (New York: Norton, 1980), 77–84. Darwin actually recognized several mechanisms of evolution, of which natural selection was the most important. See Charles Darwin, *On the Origin of Species by Means of Natural Selection*, in *The Portable Darwin*, Duncan M. Porter and Peter W. Graham, eds. (New York: Penguin, 1993), 111.

16. Although natural selection is the central mechanism in Darwinian evolution, it is not the only one. For example, random variations in the genes transmitted from parents to offspring in a population may eventually lead to the dominance of some genes over others, a phenomenon called genetic drift. See John Beatty, “Random Drift,” in *Keywords in Evolutionary Biology*, Evelyn Fox Keller and Elisabeth A. Lloyd, eds. (Cam-

bridge: Harvard University Press, 1992), 273–81. Similarly, if a natural catastrophe accidentally wipes out more striped animals than nonstriped animals in a population, the nonstriped survivors will dominate the surviving population, even if the gene for non-stripedness is not otherwise adaptive.

17. Gould, *The Panda's Thumb*, 83–84.

18. *Ibid.*, 84.

19. For attempts at such an argument, see Charles J. Lumsden and Edward O. Wilson, *Genes, Mind, and Culture: The Coevolutionary Process* (Cambridge: Harvard University Press, 1981); William H. Durham, *Coevolution: Genes, Culture, and Diversity* (Stanford: Stanford University Press, 1991); Robert Boyd and Peter J. Richerson, "Why Does Culture Increase Human Adaptability?" *Ethology and Sociobiology* 16 (1995): 125–43.

20. Stephen Jay Gould and Richard C. Lewontin, "The Spandrels of San Marco and the Panglossian Paradigm: A Critique of the Adaptationist Programme," *Proceedings of the Royal Society, London* (1979) B. 205: 581–98.

21. I believe that this distinction originates with the zoologist Richard Dawkins, but I have not been able to trace the exact source.

22. A Lamarckian theory of evolution would also predict the existence of designoid features of organisms, because organisms might adapt favorably to their environments even if they did not do so through conscious plan or intention.

23. Gould, *The Panda's Thumb*, 20–21, 27–29.

24. *Ibid.*, 22–26, 29.

25. Stephen Jay Gould, *Hen's Teeth and Horse's Toes: Further Reflections in Natural History* (New York: Norton, 1983), 156–57; Gould and Lewontin, "The Spandrels of San Marco," 594–97.

26. Gould, *The Panda's Thumb*, 27–29.

27. Stephen Jay Gould and Elizabeth S. Verba, "Extapation: A Missing Term in the Science of Form," *Paleobiology* 8, no. 1 (1982): 4–15.

28. Gould, *Hen's Teeth and Horse's Toes*, 170. In his paper with Lewontin, Gould uses an example drawn from the cultural world—the spandrels in the Basilica of San Marco—to make this point. Spandrels are triangular spaces that occur when a square of four rounded archways is topped by a cathedral dome. It was customary for artists to decorate these spaces with elaborate paintings and mosaics. Nevertheless, Gould and Lewontin note, one should not infer that basilicas were specifically designed to create spandrels for artists to decorate. Instead, the custom of decorating spandrels came later; it resulted from previous decisions about the design and construction of basilicas. Gould and Lewontin, "The Spandrels of San Marco," 582–83.

29. Stephen Jay Gould, *Ever Since Darwin: Reflections in Natural History* (New York: Norton, 1977), 107–10; Gould and Verba, "Extapation," 11–12.

30. This is true for technology as well as for cultural software. For a description of technological bricolage see Henry Petroski, *The Evolution of Useful Things* (New York: Vintage, 1992).

31. On this point see Petroski, *The Evolution of Useful Things*; David Pye, *The Nature and Aesthetics of Design* (London: Barrie and Jenkins, 1978).