

2. Bronowski says images “guard the past and create the future” (para. 12). What does he mean?
3. Bronowski refers to a wide range of authorities, from Ivan Pavlov (a biologist) to Charles Peirce (a philosopher and mathematician), to Galileo (an astronomer), and to Albert Einstein (a physicist), as well as to Philip Sidney, William Blake, Samuel Taylor Coleridge, and William Shakespeare (all poets). What is the effect of such a diversity of references?
4. How effective is Bronowski’s analogy to chess in paragraph 14? What makes it effective or ineffective?
5. What is the relationship between paragraphs 16 and 17?
6. Based on what you learned about deduction and induction from T. H. Huxley’s essay (p. 609), what do you think of Bronowski’s statement that induction “cannot be formalized” (para. 15)?
7. In paragraph 19, what does Bronowski present as common to science and literature?
8. How effectively does the example of Isaac Newton in paragraph 24 support Bronowski’s thesis?
9. In his conclusion, Bronowski states that landing on the moon would be “not a technical but an imaginative triumph.” Now that astronauts have gone to the moon, do you think of it as a technical or imaginative triumph?

The Future of Happiness

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One issue that will become central in the next fifty years is how we shall use the ability to control the genetic makeup of the human species. In the past, our ancestors used crude methods of genetic selection to determine which kinds of children survived to reproductive age. Now we are being handed the dubious gift of reaching the same goal through the auspices of science.

Long before anyone suspected the existence of genes, farmers recognized that the traits of parents were passed down to the offspring, and thus they could improve the yield of pumpkins or the size of pigs by selectively breeding the best

specimens with each other. It was then easy to apply this principle to human beings. Plato devotes a large part of the fifth book of his *Republic* to the question of how to apply the practices used to breed hunting dogs to producing rulers for the perfect State he envisions. In chapter 459, for instance, he writes:

[T]he best of either sex should be united with the best as often, and the inferior with the inferior as seldom as possible; and . . . they should rear the offspring of the one sort of union, but not of the other, if the flock is to be maintained in first-rate condition. Now these goings on must be a secret which the rulers only know, or there will be a further danger of . . . rebellion.

Earlier, in chapter 415 of Book III, he writes, "And God proclaims as a first principle to the rulers . . . that there is nothing which they should so anxiously guard, or of which they should be such good guardians, as of the purity of the race." In fact, all known societies have practiced what in retrospect we could label "eugenics" or "genetic engineering." These practices were often justified in terms that have nothing to do with biology — such as religion or custom — but presumably they were carried out because they were seen as contributing to the survival of the group. It is useful to remember that the idea of all persons having the right to reproduce is a recent one; previous societies survived by granting that privilege primarily to individuals who were likely to produce above-average children.

Positive practices encouraged the mating of individuals with desirable phenotypic traits — including health, strength, and beauty — and material success, such as wealth or power. Differential reproduction was achieved by various means: The almost universal practice of obtaining a dowry or brideswealth before marriage ensured that the future parents would have enough resources and kin support to bring up children who would not become a burden to the community.

Negative practices discouraged reproduction among individuals with traits that a given society deemed undesirable. Some of these were little more than natural tendencies: For instance, poor, unhealthy individuals were less likely to marry and have children. But other means were much more active, ranging from castration to infanticide. Often a cultural practice that seemed to have an entirely different purpose might nevertheless have a substantial eugenic impact. For instance, the Russian Orthodox Church adopted the ritual of immersing naked newborn infants in cold water in order to infuse them with the grace of the Holy Ghost and protect their souls from eternal damnation. An incidental consequence of this practice was that less than healthy infants would not survive baptism, thus removing their genes from the gene pool. One can only speculate whether such rituals survived primarily because of the peace of mind they conferred on the devout or the genetic advantages they provided. Presumably they were overdetermined, in that both sets of advantages supported their existence relative to alternatives open to the culture at the time.

Most of these practices were hit-or-miss, without any foundation in an understanding of how different traits are transmitted from one generation to the next. But this situation is about to change drastically in the coming decades. Cur-

rently two of the liveliest branches of the human sciences are behavioral genetics, which tries to ascertain the degree of inheritability of such behavioral traits as schizophrenia, propensity to divorce, political beliefs, and even happiness, and evolutionary psychology, which searches out the mechanisms by which these traits are selected and transmitted from one generation to the next. Both approaches assume that nature and nurture are implicated in shaping our behavior, thoughts, and emotions — although, contrary to the learning bias of the last century, they favor nature more.

This trend is bound to be magnified tremendously in the next half century as a result of advances in genetics. Although few important traits are likely to depend on the action of a single or even a few genes, some genetic engineers are confident that the era of “designer babies” is at hand. Even if their optimism is misplaced, it would be foolish to ignore the impending decisions we may soon confront. It is interesting that leading human geneticists, of whom my colleagues and I interviewed close to one hundred in a recent study, have rarely taken the more controversial aspects of their work seriously. Most argue that it has no relation to anything resembling eugenics. They scoff at the possibility of human cloning and see little likelihood that their discoveries can be misused. Almost unanimously, they claim no special knowledge about or responsibility for potential applications of genetic engineering; they insist that this is a political decision, to be taken by society at large — even though “society” lacks the specialized understanding to make informed decisions. The situation is not unlike what was happening in atomic physics a little over a half century ago, when even such a universal thinker as Niels Bohr maintained into the 1940s that experiments with nuclear fission could have no possible practical applications.

But ready or not, the choices will soon have to be made, and they will determine our future. For instance, let us suppose that it will be possible soon to substantially increase *g*, the general-intelligence factor that underlies the linguistic and mathematical skills prized by the educational system and useful in other spheres of life as well. Is this a good idea? Several commentators have pointed out that society is already stratified by intelligence to a troublesome extent. Whereas in the recent past people could be considered successful if they were hardworking, honest, friendly, or virtuous, without necessarily being “book smart,” nowadays abstract reasoning skills are becoming a prerequisite for any kind of material or social success. If we find ways to enhance this trait genetically, the trend may become exponential. As the division between “supersmart” and average individuals increases, so will the gap between their economic and political power. Endogamy based on intelligence — already in effect — will become more pronounced, as no one with an IQ over 200 would dream of marrying someone with an IQ of less than 150. If the engineering affects the germline, these divisions will be transmitted automatically to the next generation.

But what if, in an unlikely burst of egalitarianism, we found ways to enhance everyone’s intelligence — to raise the baseline for the entire human race? Would that be a good idea? The answer is that we don’t know. Most biological and

psychological functions that are useful in small doses are dangerous when they become excessive. As Aristotle noted, virtues become vices when taken to the extreme: Courage turns into foolhardiness, prudence into indecisiveness. The ambiguous relation of genius to insanity suggests that too much intelligence may have its own handicaps — excessive sensitivity, for example, leading to proneness to anxiety and depression. Or, to the extent that rational intelligence is linked to self-centered attitudes à la Ayn Rand¹, it may result in a species even more unfeeling and cruel than we are now.

A more basic issue is whether, having the means, we should aim for uniformity or diversity in fiddling with the human genome. The pressure for uniformity is going to be great: Everybody will want to have children who are intelligent, good-looking (by standard conceptions of beauty), ambitious, and successful. Diversity is risky. Who would want to wager on the unknown, the untested? Yet the biologist E. O. Wilson's arguments in favor of biodiversity also apply to psychological traits; the prospect of an increasingly homogeneous race is not only frightening to our humanistic sensibilities but potentially dangerous from the strict perspective of survival. Because the future is largely unforeseeable, the best strategy is to have a diverse pool of potentialities from which adaptive responses to new situations may emerge, instead of locking ourselves into a pattern that is best in terms of present conditions.

If human genetic engineering will be market-driven (instead of being dictated by a central computer that will determine how many warriors, workers, and drones society will need in the next generation), it is likely that the most intense selective pressure will be for producing happy children. When parents are asked what they hope for their children, the typical answer is that they hope the kids will be well educated and have good jobs, but above all else that they will be happy in whatever path they choose for themselves. Contemporary parents seem to agree with Aristotle, in that they understand that while every other good is a means to an end, happiness is *the* good in itself: It is what we hope to achieve through education, money, beauty, and intelligence. If it becomes possible to produce happiness through genetic manipulation, that may well become parents' first priority.

According to behavioral geneticists studying identical and fraternal twins reared together and apart, at least 50 percent of happiness is genetically inherited. One might have some justifiable reservations about how "happiness" is measured in such studies, but the fact that there is a set point of happiness different from one individual to the next and relatively impervious to external ups and downs seems well established. Of course, the general level of happiness in a population is also affected by economic conditions (having more money is related to happiness, up to a point, but past the threshold of income that would be average in Por-

¹Ayn Rand (1905–1982), author and philosopher. Rand founded the Objectivist movement, which argued that the purpose of life is the pursuit of one's own happiness. — Eds.

tugal or South Korea additional income does not correspond to more happiness), the political situation, and many other external variables. Nevertheless, one's genetic inheritance plays an important role.

So let us suppose that in the decades ahead it will be possible to enhance the likelihood of our children's happiness through genetic engineering. Are we going to do them a favor by availing ourselves of this opportunity? Will society, and the species as a whole, benefit from such a choice? In speculating on what the answers to these questions may be, we might start by reviewing the little we know about happiness at this point.

In the first place, it seems clear that people's self-report of how happy they are is a fairly valid measure of their happiness. It correlates highly with the perception of family and friends, with the incidence of pathologies and relevant behaviors — in short, people who think they are happy also look and act like happy people are supposed to. They tend to be extroverted, they have stable relationships, they live healthy and productive lives. So far, so good.

But there might be some interesting downsides as well. For instance, one of the most widely accepted definitions of happiness is that it is a state in which one does not desire anything else. Happy people tend not to value material possessions highly, are less affected by advertising and propaganda, are not as driven by desire for power and achievement. Why would they? They are happy already, right? The prospect of a society of happy people should be enough to send shivers down the spine of our productive system, built on ever-escalating consumption, on never-satisfied desire.

Will academic psychology be of any help in providing answers to these impending choices? Until about two decades ago, the discipline had very little to say about happiness. It was considered too "soft" an issue for serious scientific study. To make a difference in this quandary, psychology will have to focus once again on its original object, the psyche — not as an ephemeral, mystical, soul-like substance but as a set of the very concrete phenomena that transpire in our consciousness as our attention is turned to apprehending, integrating, and responding both to external stimuli and to internal states (that is, thoughts and emotions). The stream of consciousness is considered by most scientists, including psychologists, to be too subjective for rigorous study, while in fact it is the most objective datum we have access to. Scientific facts and the knowledge based on them is hearsay that I am glad to accept on faith, but the events in consciousness, such as fear, joy, anger, hope — to them I have immediate access and their reality is beyond question.

For my part, I determined to develop a systematic phenomenology that would find answers to the following kinds of questions: How do people's thoughts, feelings, goals, and actions fluctuate during an average day? During a lifetime? How are these components of the stream of consciousness related to each other? When do people feel happy in everyday life? Any one of these questions could in turn generate dozens of further ones, including investigations of how age, gender, ethnicity, and other such differences affect consciousness and how patterns measured at

one time relate to patterns measured years later. Among the things we learned is that people who are engaged in challenging activities with clear goals tend to be happier than those who lead relaxing, pleasurable lives. The less one works just for oneself, the larger the scope of one's relationships and commitments, the happier a person is likely to be.

It is also important to realize that consciousness has its own specific reality, which is immediately destroyed when one begins to analyze it in terms appropriate to less complex systems. For one thing, it is an open system, whose states constantly change through time. What's on my mind now, for instance, cannot have been accurately predicted by what was on my mind a minute ago, even if you had all the information about my brain chemistry, genetic background, past learning, and so forth, sixty seconds earlier. What happens between time 1 and time 2 is that any sound, sight, feeling, or idea that enters consciousness during that minute may set my thoughts and feelings on an entirely new and unpredictable course.

This indeterminacy can be seen most clearly in creative activity. It is generally thought that the elements of a poem (or a sonata, a painting, a scientific theory) could be retrieved from the poet's mind if we had enough information about the contents of that mind. That is, in a distant analogy to the homuncular theory of embryonic development, we believe that the creative work is contained — even if only in some microscopic or codified form — within the creator. But that is not the case. A poet may start with a single word or phrase — a word or phrase that is meaningless or ordinary but which at that particular moment seems compelling to him. Why the word or phrase is suddenly meaningful might be explained if you knew what the poet was thinking or feeling just before. But what happens next is not: The word may suggest ideas and associations that were not predictable, and these in turn open up new directions of thought and feeling, which lead to more words, and so on in an expanding circle of meaning that is the result of an emerging, autonomous, self-organizing system — still based on the poet's past consciousness but no longer reducible to it.

One need not turn to creativity to illustrate this process. Let's take a more universal event, the reaction of parents to their newborn child. Genetic and evolutionary psychology can tell us a great deal about how and why parents bond with their offspring. Parenting is one of the oldest human experiences; it has been the experience of every generation since the beginnings of our species. Nevertheless, even if one knows everything about babies and birth, seeing one's own child for the first time is an event so *sui generis* that nothing can adequately prepare one for it. Its nuances depend on how one feels about one's spouse, one's financial situation, one's life in general — to say nothing of the baby's physical appearance and behavior — and all of these elements are striving to achieve meaningful combination with the main event, the birth of the baby. You can guess what that combination will look like by knowing as much as possible about the parent, but the prediction will be imprecise, because too many of the variable factors that affect the parent's consciousness are external.

If psychology were to take the stream of consciousness for its territory, it

might begin to provide the kind of knowledge that we will need to make enlightened choices about the sort of future we want. With every increase in knowledge, our responsibilities increase. In the past, we were like passengers on the slow coach of evolution. Now evolution is more like a rocket hurtling through space, and we are no longer passengers but its pilots. What kind of human beings are we going to create? Flesh-and-blood copies of our machines and computers? Or beings with a consciousness open to the cosmos, organisms that are joyfully evolving in unprecedented directions?

Psychology is beginning to show signs of moving in the latter direction. At various centers in the United States and abroad, topics like wisdom, life goals, intrinsic motivation, spirituality — all of which would have been outside the pale a few decades ago — are being investigated by serious scholars. During his recent presidency of the American Psychological Association, Martin E. P. Seligman established within the profession a “Positive Psychology” movement, which reaches beyond the traditional goals of healing mental afflictions. Among its accomplishments so far has been the development of a list of “strengths” that are ubiquitous across times and cultures — such as wisdom, valor, perseverance, and integrity. As a next step, the knowledge of how such strengths are cultivated is being assembled. Eventually this knowledge should permeate the profession, giving it equal weight with the practice of therapy and prevention. We will need such a science to confront successfully the challenges of the next fifty years.

Exploring the Text

1. What is Mihaly Csikszentmihalyi referring to as a “dubious gift”? How is it dubious? How is it a gift?
2. In paragraph 2, Csikszentmihalyi says, “it is useful to remember that the idea of all persons having the right to reproduce is a recent one; previous societies survived by granting that privilege primarily to individuals who were likely to produce above-average children.” How does he prove this radical statement? Are his examples convincing? Explain.
3. In paragraph 5, the author writes of “the learning bias of the last century.” How does his language in that phrase influence your understanding of his position?
4. What does Csikszentmihalyi suggest about the relationship of science, technology, and politics (para. 6)? What might be the positive and negative effects of this relationship? What would be the ideal relationship?
5. What is the effect of Csikszentmihalyi’s reference to E. O. Wilson, the eminent evolutionary biologist, in paragraph 9? Do you accept his argument? If yes, what rhetorical move did you find most convincing? If no, what rhetorical move would you have made to make the argument more convincing?
6. Do you agree with Csikszentmihalyi’s posited characteristics of happiness (para. 14)? What would be the effect of a population like the one described?
7. What is ironic about the relationship between happiness and pleasure (para. 16)?