Why we need better ethics for emerging technologies

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Abstract. Technological revolutions are dissected into three stages: the introduction stage, the permeation stage, and the power stage. The information revolution is a primary example of this tripartite model. A hypothesis about ethics is proposed, namely, ethical problems increase as technological revolutions progress toward and into the power stage. Genetic technology, nanotechnology, and neurotechnology are good candidates for impending technological revolutions. Two reasons favoring their candidacy as revolutionary are their high degree of malleability and their convergence. Assuming the emerging technologies develop into mutually enabling revolutionary technologies, we will need better ethical responses to cope with them. Some suggestions are offered about how our approach to ethics might be improved.

Introduction

New technological products are emerging. We learn about them regularly in the news. Information technology continually spawns new and popular applications and accessories. Indeed, much of the news itself is produced and transmitted through ever newer and more diverse information technology. But it is not only growth in information technology that is salient; other technologies are expanding rapidly. Genetic technology is a growth industry with wide applications in foods and medicine. Other technologies, such as nanotechnology and neurotechnology, are less well established but have produced striking developments suggesting the possibility of considerable impact in the not too distant future.

The emergence of these potentially powerful technologies raises the question about what our technological future will be like. Will the quality of our lives improve with increased technology or not? I believe the outcome of technological development is not inevitable. We at least collectively can affect our futures by choosing which technologies to have and which not to have and by choosing how technologies that we pursue will be used. The question really is: How well will we choose? The emergence of a wide variety of new technologies should give us a sense of urgency in thinking about the ethical (including social) implications of new technologies. Opportunities for new technology are continually arriving at our doorstep. Which kinds should we develop and keep? And, how should we utilize those that we do keep?

The main argumentation in this paper is to establish that we are living in a period of technology that promises dramatic changes and in which it is not satisfactory to do ethics as usual. Major technological upheavals are coming. Better ethical thinking in terms of being better informed and better ethical action in terms of being more proactive are required.

Technological revolutions

“Technology” is ambiguous. When speaking of a particular kind of technology, such as airplane technology, we sometimes refer to its paradigm and sometimes to its devices and sometimes to both. A technological paradigm is a set of concepts, theories and methods that characterize a kind of technology. The technological paradigm for airplanes includes the concept of a machine that flies, the theory of aerodynamics, and the method of using surfaces to achieve and control flight. A technological device is a specific piece of technology. The Wright brothers’ airplane and commercial jetliners are examples of technological devices. Technological devices are instances or implementations of the technological paradigm. Technological development occurs when either the technological paradigm is elaborated in terms of improved concepts, theories, and methods or the instances of the paradigm are improved in terms of efficiency, effectiveness, safety, etc. Of course, technological development has occurred in numerous technologies over thousands of years.
But in some cases technological development has an enormous social impact. When that happens, a technological revolution occurs.\(^1\) Technological revolutions do not arrive fully mature. They take time and their futures, like the futures of small children, are difficult to predict. We do have an idea of how children typically develop and likewise I believe we have an idea of how revolutions typically develop. I will try to articulate that conception in terms of a plausible model of what happens during a typical technological revolution.

We can understand a technological revolution as proceeding through three stages: the introduction stage, the permeation stage,\(^2\) and the power stage.\(^3\) Of course, there are not sharp lines dividing the stages any more than there are sharp lines dividing children, adolescents, and adults. In the first stage, the introduction stage, the earliest implementations of the technology are esoteric, often regarded as intellectual curiosities or even as playthings more than as useful tools. Initially only a few people are aware of the technology, but some are fascinated by it and explore its capabilities. Gradually the devices improve and operate effectively enough to accomplish limited goals. Assuming the technology is novel and complex, the cost in money, time, and resources in using the technology will typically be high. Because of these limitations the technology’s integration into society will be minor and its impact on society will be marginal.

In the second stage, the permeation stage, the technological devices are standardized. The devices are more conventional in design and operation. The number of users grows. Special training classes may be given to educate more people in the use of the technology. The cost of application drops and the development of the technology begins to increase as the demand for its use increases. The integration into society will be moderate, and its overall impact on society becomes noticeable as the technological devices are adopted more widely.

Finally, in the third stage, the power stage, the technology is firmly established. The technology is readily available and can be leveraged by building upon existing technological structures. Most people in the culture are affected directly or indirectly by it. Many understand how to use it or can benefit from it by relying on people who do understand and use it. Economy of scale drives down the price and wide application provides pressure and incentive for improvements. The integration into society will be major and its impact on society, if it is truly a revolutionary technology, will be significant. The impact of the technology on society is what marks it essentially as revolutionary. Toasters have undergone technological development, but toaster technology has not had a significant level impact on our society. As wonderful and improved as toasters are, there is no toaster revolution; whereas there has been a technological revolution due to developments of the automobile and electricity. Take toasters out of society and not much is changed. Remove automobiles or electricity and our contemporary society would have to make massive adjustments.

This tripartite model for an open technological revolution is summarized by Table 1. Social impact inevitably reflects the other factors mentioned in the table and in addition includes the effect the technology has on the behavior and practices of the society. A technological revolution has a large scale transforming effect on the manner in which a society functions.

In giving this description of technological revolutions I have been making some assumptions which need to be made more explicit. This is a model of open technological revolutions in the sense that the revolution occurs in an open society and the technology is accessible directly or indirectly by the general public as a good or service over time. I have been assuming a liberal democratic state in which market forces, even if regulated, play an important role. These are the conditions under which technological revolutions can flourish. The automobile revolution and electrification revolution are examples of reasonably open technological revolutions. In closed revolutions the access to the technology remains severely restricted by social, political, or economic forces. For example, a ruling elite or a military may maintain control by limiting access and use of particular technologies. The development of nuclear weapons would be an example of a closed technological revolution. Closed technological revolutions by definition will control the dispersal of the technology so that they are unlikely to proceed through all of the aspects of the permeation and power stages in this model. Here we will be considering open technological revolutions granting, of course, that the

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\(^1\) The term “revolutionary technology” is used colloquially sometimes to describe new and improved technological devices. A new mousetrap might be said to be “revolutionary” if it catches many more mice than earlier models. I will use “revolutionary technology” in a much stronger sense requiring that the technology have significant social impact.
