Technology in an Alternative Modernity

Yanfeng Lu

To my extended big family,

who provided unconditional support for my PhD study

Prefactory Notes and Acknowledgments

It has been over two years since I submitted my dissertation. During this period some ideas in the dissertation have undergone further development. But since I tried hard to control the scope of the work, I feel the best choice now is to keep the contents intact. Otherwise I would have to increase the size of an already lengthy volume. In preparing for this formal edition I have put effort in improving the language. However, as English is not my native language and it's difficult to obtain sufficient help with a work of such size from appropriate native speakers, many flaws still remain. I ask for tolerance from the reader in this regard.

My PhD study in Germany achieved its original goal, a major part of which was to obtain a first-hand experience of the European society and write down some thoughts. The ideas which I had been pondering on for many years were systematically formulated and this set the framework for future study. However going back to college at a late phase of life was not an easy endeavor. Without the help from various sources it would have been much more difficult.

First my heartfelt thanks naturally go to my primary advisor Prof. Dr. Armin Grunwald, who essentially made this study possible. When I first contacted him he gladly accepted me as a PhD student. Then he helped me obtain a Visa and become a PhD candidate in the School of Humanities and Social Sciences at Karlsruhe Institute of Technology (KIT). In the process of the study he offered me valuable comments and advised me on relevant resources. His help extended from the study to my personal life in Germany. He kindly provided me a financial support at his Institute for Technology Assessment and Systems Analysis (ITAS). He even played a crucial role in granting Visas to my family and assisted me in job hunting. Despite an intensive work schedule his responsiveness was truly impressive. I also want to express my gratitude to Prof. Dr. Michael Decker, who arranged my work at ITAS, which was very beneficial to my PhD study. I am grateful to Prof. Dr. Hans-Peter Schütt for taking the role of my secondary advisor. I learned a lot from his comprehensive knowledge of Western thought and unrestricted discussion with him. The comments from many other people are also appreciated. Outside KIT, our friend Dr. Li, Ming recommended me two important books in postmodern medicine and

made relevant copies for me. They were used in the case study of modern medical technology. I owe him thanks too.

Of course such an endeavor also required the support from my family. Giving up a highly paid IT job for academic research didn't only affect my own life. I especially thank my wife Xu, Yinghui for her understanding of the meaning of this endeavor. It brought about some hardship in our family life with a very young child, including an unexpected long period of separation due to visa issues. She acted courageously to overcome the difficulties. And during the hard time our extended family offered unconditional support. To this I can only feel lucky and indebted. With sincere appreciation and gratitude this book is dedicated to my big family.

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Introduction

In this introduction I clarify some general matters of this essay. The Background and Motivation section puts this PhD study in context, including the historical context, the current state of philosophy of technology and some personal background. The General Approach section explains some general aspects of methodology. The Structural Overview section lays out the general structure of the essay.

Background and Motivation

Historical Context

In five centuries Western modernity has expanded to many parts of the world and it has dominated humanity for the past two centuries. Modern science and technology, as one pillar of Western modernity, have been well accepted almost everywhere on the globe without much resistance. But it's not the case with capitalism and democracy, other pillars of Western modernity. The acceptance of capitalism and democracy is uneven among the traditional cultural spheres. They have taken root in India after centuries of British colonization, although with some cultural resistance. They have been welcome in the traditional Chinese cultural sphere mostly recently, except Japan as the pioneer, which achieved fast modernization in the 19th century. South Korea, Taiwan, Hong Kong and Singapore are newcomers whereas mainland China has started to adopt capitalism to a certain extent. But in the Muslim world the resistance is tenacious, with religious conflict with the West as a major reason.

With the decolonization after the Second World War and the globalization at the turn of century, human history has entered a new phase. Instead of a few power or superpower nations dominating the international stage, more and more nations are playing more and more important roles. As we enter the new millennium, humanity is bundled together more than ever before. We have to work together to face our common challenges. This has become obvious in handling the recent global financial crisis and global warming. G-8 has to be

replaced by G-20. That's symbolic. As the world moves to being multi-polarized, nations are becoming more and more conscious of keeping their own cultural identity and protecting their own cultural heritage. Certainly most nations want modernization (no matter how they interpret it), but they just don't want to copy everything from the West. The recent Afghanistan and Iraq wars clearly showed how difficult it was to export democracy by force. This could well be the death toll of an age of hegemony and unilateralism.

The concept of alternative modernity gains much significance in this context. The West has led humanity into modernity. This has become an irreversible trend. No matter what the interpretation is, modernity has been primarily associated with progress. But Western modernity is probably not the only way to modernity. In fact, from Marx through the Critical Theorists to postmodernists Western intellectuals have brought up much criticism of Western modernity. And from the Critical Theory has evolved the contemporary alternative modernity theory, represented by Andrew Feenberg's philosophy of technology. Criticisms in many cases are accompanied with proposed solutions. Therefore, alternative modernity is not just a concern of non-Western cultures. The Western societies themselves also strive for some reforms.

Most of the criticism made by Western intellectuals has been done from within the Western culture. Instead, this essay is intended to provide a cross-cultural perspective. It tries to propose a strong alternative modernity theory in contrast to a weak one. To achieve that, it has to examine Western modernity from a comparative perspective. Specifically Chinese culture is used as an important reference. The characterization of Western modernity is done in comparison with Chinese culture.

The State of Philosophy of Technology

Modernity is undoubtedly intertwined with technology. On the one hand modern society is unimaginable without the support of modern technology. If any major technology was taken away, modern society would malfunction, in the worst case even collapse. On the other hand technology also has been heavily shaped by modernity. Traditional technology encompassed a wide range of methods. But modern technology has been more and more intertwined with modern science. Traditional technologies that cannot be incorporated into the scientific worldview are often abandoned, or at least suspected. This close relation between modernity and technology is reflected in a new phenomenon, the dominance of modern technology in modern society.

Early criticisms of Western modernity recognized the important role of modern technology, but it was not treated as a target. For instance, Marx's main target of criticism was capitalism. He didn't see any big problem with modern technology, although the capitalist economy was built on top of large scale production with machines. Modern technology became an issue in later criticisms of Western modernity. It's evidenced in Heidegger, the Critical Theorists and Ellul, among others. This can be counted as the starting point of modern philosophy of technology. A distinct feature of these early theories of technology was that they treated modern technology as a general entity in the large context of Western modernity. Due to the rapid development of the field, this is already called "classical philosophy of technology." Contemporary philosophy of technology is developed out of some major complaints about classical philosophy of technology. Brey summarizes them into three criticisms, which accuse it to be pessimistic, deterministic and too general and abstract, respectively (Brey 2010: pp. 38-39).

The transition from classical to contemporary philosophy of technology has now been recognized as an "empirical turn." This title is primarily related to the third criticism above. "Empirical" is said against "general" and "abstract." A common feature of contemporary philosophy of technology is attention to details. Technology is no longer treated as one so-called "with a capital T." Philosophers are more and more interested in specific technologies and specific aspects of technology (design process, engineering knowledge, etc.). With this change of general approach the other two aspects are also affected. Attention to details obviously makes the theories less pessimistic and deterministic. However, different theories are affected to different degrees. Borgmann was included in *American Philosophers of Technology: The Empirical Turn* (Achterhuis ed. 2001), but the general tone of his theory is close to classical philosophy of technology. His view of modern technology is to a large extent still pessimistic and deterministic. A significant part of the contemporary philosophy of technology is still concerned with the relationship between technology and society or culture. Brey calls this society-oriented approach. A more radical revolt against classical philosophy of technology is the engineering-oriented approach. This approach focuses on engineering processes, components and products themselves and emphasizes description rather than evaluation of technology with reference to its social context.

Compared with classical philosophy of technology contemporary theories of technology generally have less concern with modernity issues. Among the major contemporary philosophers of technology Borgmann and Feenberg have direct concern. Dreyfus's critique of artificial reason is closely related to the scientific worldview, which is an essential part of Western modernity.

Modernity issues already find little place in Ihde's new phenomenology. The engineering-oriented theories go further to play down all normative issues. Even the recently developed ethics of technology pays much attention to moral issues on the micro level and tends to ignore the general context where modern technology is developed and applied. All in all we see a gap between the micro and macro approaches yawning wide. The conflict was vehemently demonstrated in Winner's charge that social constructivism opened the black box and found it empty (Winner 1993). Recently Brey also expressed the concern that the society-oriented and engineering-oriented approaches might drift apart (Brey 2010: p. 45).

Effort has been made to close the gap. The anthology *Modernity and Technology* (Misa et al. eds 2003) is an important part of it. The approach suggested by Brey is methodological. Particularly he advocates four types of interlevel analysis: decompositional analysis, subsumptive analysis, deductive analysis and specificatory analysis (Brey 2003: p. 68). These methods are intended to bridge the micro-macro gap. Feenberg's approach is conceptual instead. For him the gap between technology studies and modernity theory is not one involving different levels, but different concepts of technical rationality. Modernity theory maintains a differentiation of rationality from society. Technology studies reject this conception and reveal the social context of technical rationality. However they "lose part of the truth when they emphasize only the social complexity and embeddedness of technology and minimize the distinctive emphases on top-down control that accompanies technical rationalization." (Feenberg 2003: p. 74) Therefore a synthesis of technology studies and modernity theory calls for combination of both fields. On the one hand the concept of technical rationality in modernity theory should be "revised to free it from implicit positivistic assumptions." On the other hand we should "preserve modernity theory's insight into the distinctiveness of modernity and its problems." (*ibid*.: p. 75)

This essay also attempts to combine technology theory with modernity theory. It generally adopts Feenberg's approach, although both theories contained in it are different from his.

Personal Background

I came from China and was educated in both computer science and philosophy. Then I went to the US to continue my study in both fields. Once I lived in the US I had the chance to put Chinese and American cultures side by side and reflect on them. On one side is an eastern culture in the early phase of modern-

ization and on the other a Western culture with a fully developed modernity. The stark contrast could be felt in many aspects of society. As China was undergoing modernization, modernity was already a big concern for me when I was in college. But the life in the US gave me the opportunity to have a direct experience of a modern society and make some deeper reflection on it. On the other hand my Chinese background provided me a different perspective when I was pondering on Western modernity. I sort of had a view from outside.

In the first decade of the 21st century the Chinese society went through dramatic change. More and more I felt the urge to go back and have a direct experience. The general impression was that material life there was getting closer to the American society. Supermarkets filled with all sorts of goods, a big net of expressways and private vehicles were just several examples. Chinese students studying in the US today would definitely feel much less cultural shock than my generation. However, as the initial excitement faded away, I could feel the fundamental difference again. Anyway, Chinese modernization is still a theoretical problem to be tackled.

The plan to live in Europe for some time came out long time ago. I had been well aware of the difference between the American and European societies. Again I wanted a first hand experience. I believed this was necessary for me to formulate a less biased modernity theory. In any event Europe is where modernity was born. After ten years of work in the IT industry I thought it's time to concentrate and write down years of thinking. My background in computer science and philosophy made the choice of philosophy of technology rather natural. And as discussed above technology is also closely related to modernity. Finally a PhD study in the field of philosophy of technology in Germany met my various needs well. From the life in Germany I did experience some important differences between the American and German societies. Among them the most prominent are a strong environment consciousness, a comprehensive welfare system including free education and governmental support for museums, theaters, etc. This definitely broadened my view of Western modernity. If we regard the modernity embodied in the American society as a reference, the German society displays an alternative modernity in some important aspects.

About a dozen years ago a prototype was already in shape. It has undergone significant development since then. Compared with the prototype I now have something much richer. This essay draws much from my personal background. The modernity theory presented here is based on my life in the Western modern societies, especially the US, and reflections from a comparative perspective. The technology theory benefits from my work in the IT industry. The philosophical training I received enables me to handle philosophical is-

sues at ease. As an enthusiastic amateur photographer I even incorporate my experience from photography practice into the essay.

General Approach

Treat Western Modernity as a Theoretical Concept

The difference between modern and traditional societies is easily discernible. A major task of modernity theory is to characterize modern societies. Unfortunately this is not an easy task. Modernity is such an elusive concept that consensus is difficult to reach. Each major modernity theory picks a different feature set to characterize modern societies. Brey clearly distinguishes two types of modernity theories: the cultural-epistemological theories and institutional theories (Brey 2003: pp. 36-37). The former focus on cultural forms and modes of knowledge, whereas the latter on social and institutional structure. Generally this is a distinction between cultural and social theories. Related to the different focuses on modern societies is disagreement on the beginning of modernity. The cultural theories tend to regard Renaissance in the 15th-16th century as the beginning of modernity. In contrast the social theories normally put the starting point at the Industrial Revolution and political revolutions in the 18th century.

Various complicated factors cause this lack of consensus. First, the transition from traditional to modern society in the West was a gradual process. In addition, the development of different areas of society was uneven. Ideas are always easier to formulate than institutions. Culture always advances faster than economic and political structure. Second, major Western modernized nations had their own particular situations and followed different paths of modernization. So they may bear particular characteristics. Third, what makes things more complex is that, these nations have realized problems in modernity and made reforms in various forms. Some have deviated from certain principles of Western modernity.

Under these circumstances the modernity theory proposed in this essay is not intended to be an accurate characterization of Western modernity. Rather it represents a particular perspective. Specifically this is a comparative perspective, from which Western modernity is examined in a cross-cultural context. For one thing, when Western modernity is viewed from within Western culture, it's more like a dramatic breakaway from the past. But when it's viewed

from outside of Western culture significant continuation from the traditional Christian culture is detectable. From this general perspective the following approaches are adopted in characterizing Western modernity. First, modern society is considered as a whole and all the areas including culture, economy and politics are taken into account. Ideas are treated on the same footing as institutions. Second, the American society is given higher priority. Due to its unique history the American society on the one hand inherited many elements from Western Europe, but on the other hand it also freed itself from many traditional constraints. The result is that it has carried the spirit of Western modernity to a powerful extreme. Third, the reforms in Western societies are recognized. These new elements are treated as deviation rather than part of Western modernity. The notion of postmodernity adopts similar approach, but it at the same time assumes that Western modernity is the only possible form of modernity. That's why it calls deviation from Western modernity "post*modernity*." In contrast this essay holds a broader notion of modernity (cf. Part I). It takes deviation as an alternative instead.

Generally Western modernity is a theoretical concept. It's an abstraction that may not match any specific modernized Western society perfectly, including the American society. Besides, it only corresponds to a particular historical period. So it's normal to see deviation in contemporary Western societies. But just like concepts such as straight line and plane in geometry this abstract concept captures essential aspects of a historical condition, which has become so significant for the whole humanity. Its focus is put on how the traditional society was transformed. So it provides a good model and reference for societies to build a viable alternative, for the non-Western cultures and the Western as well.

Combine Micro Technology Analysis with Macro Modernity Issues

Modernity is just one subject of this essay. The other is technology. On the background of the current state of philosophy of technology, this essay contains an effort to combine technology theory with modernity theory. The technology theory proposed in the essay is built on various contemporary theories. The spirit of the empirical turn is carried to a significant extent. The theory is based on an analysis of technology into three elements. Many details of technology are included in the analysis. Specific technologies are also used as examples to illustrate the ideas. The theory's view of modern technology is neither pessimistic nor deterministic. The key ideas of the culture-ladenness of

technology and the limit of technology from contemporary theories are incorporated. On the other hand, the determination of technology is also recognized to a certain extent. And more importantly, the instrumentation of technology is revived in a special way. These are key ideas from the two traditional theories, technological determinism and common sense instrumentalism. Generally we have a theory which is a synthesis of major traditional and contemporary theories and is based on detailed analysis of technology.

However, the modernity issues in the classical philosophy of technology are not ignored. Instead of the deterministic view of modern technology, the dominance of modern technology is recognized as a basic phenomenon of modernity. First, as classical philosophy of technology claimed, this is the direct cause of many modern malaises. Second, this phenomenon needs to be explained. But it cannot be explained by modern technology itself, as classical philosophy of technology maintained. Instead it has to be explicated in a large cultural context. Here is where the technology theory and the modernity theory can work together. Specifically, the technology theory explains why technology dominates in such and such a cultural context and the modernity theory explains why such a cultural context becomes reality in modern society. In this way the two theories are combined.

Further, micro technology analysis and macro modernity issues are combined with a technology theory about the relationship between technology and culture that are sensitive to both. Micro analysis and macro issues don't have to be independent of each other. If we consider modern technology as a box, then classical philosophy of technology treats this as a black box and is mostly concerned with the relation between the box and its large context. On the contrary, contemporary philosophy of technology opens the black box and discloses what's inside. Nevertheless it tends to overlook the large context, although it also pays attention to the area near the periphery. There is no reason why we cannot have a integrated picture that includes both the inside and outside of the box.

Focus on Technology

With a subject as broad as modernity, how to control the scope of the essay is always an issue. In a dissertation one can only handle a limited number of topics. However the modernity theory I want to propose involves general characterization. Leaving out any part would damage the integrity. So the best choice is to include all the parts and outline the basic ideas. Compared with modernity technology is a much more specific subject. Due to the limit of

scope, this essay has to focus on technology. The core question this essay tries to answer is, what should we do with modern technology? In this way the modernity theory has to be kept sketchy. But it's necessary for answering the core question, for the simple reason that modern technology cannot be well understood without modernity as a whole. The modernity theory provides the historical and cultural context for a theory of modern technology. Generally a sketchy modernity theory is treated as a framework, in which a full-scale technology theory is proposed in this essay.

The wide range of modernity is demonstrated in the many topics involved. As we will see, almost all the major areas of philosophy are touched, from metaphysics through philosophy of science to political philosophy. Yet the issue of modern technology provides a nice piece of glue to stick all the various thoughts and ideas together. It's just impossible to include sufficient argumentative support for each of the ideas. But positions directly related to the core question are based on solid arguments. In this way the essay keeps focused, but on the other hand it also brings up many topics for further development in the future.

Structural Overview

After a general proposal of an alternative modernity theory, the essay gets into details about the interaction between technology and culture and then how technology should fare in that alternative modernity. Finally Chinese traditional society and modernization and the specific fields of medical and information technologies provide good case studies. So the whole essay is divided into four parts.

In Part I a preliminary alternative modernity theory is proposed. On the basis of a historical survey of Western modernization, some essential features of modernity are extracted from the key events or movements in **Chapter 1**. In particular, individualism and industrialization are identified as the two general essential features of modernity. Roughly individualism covers the political and cultural areas and industrialization covers the economic area. They jointly distinguish a modern society from a premodern one. **Chapter 2** talks about alternative modernity. An alternative modernity is said against Western modernity, which is treated as a model and reference. The essential features of modernity are extracted from Western modernity. An alternative modernity also must be based on Western modernity. In order to clarify what can be counted as an alternative, essential and peculiar features of Western moder-

nity need to be identified. These are scientism, capitalism-commercialism and democracy. A common thought behind them, egalitarian universalism, is also unveiled. So a form of modernity has to go beyond these features in order to be an alternative to Western modernity. This is a strong alternative modernity compared with Feenberg's weak one.

Part II is a preparation for the technology theory of this essay. Several major existing theories of the relationship between technology and culture are examined. The examination is carried out on the basis of an analysis of technology, which is the task of **Chapter 3**. Specifically, built on the dual characterization of technical artifacts, technology is analyzed into three major elements, the scientific, design and functional elements. These three elements are not separable components of technology, but just different aspects of the same entity. However, the analysis makes the examination of the existing theories clearer and easier. The theories are grouped into the traditional and contemporary theories, along the neutrality vs. culture-ladenness dichotomy. **Chapter 4** deals with the traditional theories. It's demonstrated first that the general foundation of neutrality is the scientific element of technology. For this purpose the neutrality of science in a certain sense is defended against historicism, post-modern criticism and constructivism. Technological determinism and common sense instrumentalism both claims the neutrality of technology. The former regards technology as an autonomous determining power, whereas the latter treats it as an instrument that fits into a straightforward functional slot. The contemporary theories of technology are discussed in **Chapter 5**. Similarly, the design and functional elements of technology are shown as the foundation of its culture-ladenness. This is a relatively easier task. Then three major theories are examined. Feenberg's theory of underdetermination is derived from the constructivist theory of technology. It claims that technical factors themselves cannot determine the design of a technology. So it has to do with culture-ladenness in terms of design. Ihde's ambiguity theory reveals that the function of a technology is ambiguous without a particular cultural context. The same technology could have quite different functions in different cultural contexts. This is in fact a theory of culture-ladenness in terms of function. Finally Winner's politics of artifacts theory can be deemed as having to do with culture-ladenness in terms of both design and function.

Part III is the core of this essay. It develops a synthesized theory of technology on the ground of the existing theories and then combines it with the modernity theory to provide an answer to the core question. What should we do with modern technology? On the one hand we should embrace it with all the benefits and progress it brings. On the other hand we should control it in order to avoid the problems it causes. Generally speaking this is an *embracing-*

controlling-stance on modern technology. This may appear to be a common sense. But the thinking behind it is far from trivial. First an inspiration for the embracing-controlling-stance can be obtained from the field of photography. **Chapter 6** spells out that inspiration. Photography carries the combination of technology and art. Although photography equipment is loaded with cutting edge modern technologies, technology can only facilitate photography practice to a certain extent. Of the four basic elements of photography works technology may help with exposure and focusing, but can contribute nothing directly to composition and attractiveness. These latter two are the art part, which is the core of photography. So the general message about technology in photography is that, it helps but falls short of the core.

The following two chapters handle the two aspects of the general stance in turn. To defend the embracing stance the dystopian substantivism of modern technology needs to be rebutted. This is one major task of **Chapter 7**. Specifically four influential substantivist theories of modern technology are examined. They are Heidegger's Ge-stell as a new ontology, Ellul's predominant efficiency, Marcuse's one-dimensional thinking and Borgmann's device paradigm. They all treat modern technology as a substantial part of culture that shapes the whole culture. For each of the theories the feature it picks is explained in the general cultural context. The goal is to show that modern technology is not the real culprit of the various problems in modernity. Instead we need to find the root cause in the cultural context around modern technology. Once modern technology is proved innocent it can be whole-heartedly embraced. The main theory of the essay is introduced in the second half of the chapter. It's a technology theory called *cultural instrumentalism*. Its central claim is that technology is a culture-laden instrument of the core of culture. A key idea is to divide culture into material, lower and higher cultures, so that the subtleties in the relationship between technology and culture can be better captured. It turns out that all the major existing theories become a part of this synthesized theory. Then this theory and the modernity theory are combined to interpret the phenomenon of modern technology. A preliminary prescription for the modern malaise is also suggested. It's no other than going for an alternative modernity.

Chapter 8 deals with the controlling stance on modern technology. A three step approach is adopted. The first step of control is to recognize the limit of technology. The focus here is the strong Artificial Intelligence (AI) and Dreyfus's critique of it. But they are both put in a larger context. The strong AI, which is supposed to create human intelligence with computers, is put in the materialistic worldview of modern science. And Dreyfus's critique of artificial reason is interpreted as an important step on the path leading toward a new

worldview. That can be called organizational naturalism. In the materialistic worldview everything can be reduced to its matter. On the contrary, organizational naturalism recognizes organization as another dimension of the world besides matter. Further natural and cultural evolutions have generated an organizational spectrum containing five major levels of organization. With this organizational spectrum a variety of existing fundamental dichotomies can be reconciled, including that between rationality and meaning, a basic issue in the modernity theory. Generally speaking, the limit of modern technology is due to the materialistic worldview it adopted with modern science. Hence it falls short of meaning and high values. The second step of control is to show that even within its limited scope modern technology needs to be further controlled owing to its unprecedented power. Without appropriate control irreversible damage could result. The focus here is the environmental problem. The power of modern technology has greatly increased the scope of human actions. A certain kind of new ethics is needed to cope with this new situation. The third step is about a direct control of modern technology. That is the recent development of technology assessment and regulation. The assessment is performed by professional institutes on specific technologies and the regulation is carried out by the government mostly enforced by established laws. So this is a direct control compared with environmental ethics. When a direct control is carried out properly it can be much more effective and high values may be directly embedded in it.

After the central embracing-controlling-stance on modern technology is defended, it's applied to four cases in Part IV. The cases are traditional China, Chinese modernization, medical technology and information technology. The former two cases are relatively general, whereas the latter two more specific. The four chapters in this part handle these cases in turn. **Chapter 9** is about traditional China. The interest in it still lies in its technology. Needham's famous study has revealed the fascinating world of Chinese technology. Although technology was well developed in traditional China, it never dominated culture. What stood in the center of Chinese traditional culture is a unique type of humanism. On the one hand technological innovations were highly encouraged, but on the other hand technology only played a subordinating role. In general traditional China offered a perfect historical implementation of the embracing-controlling-stance. When history entered the Modern Age the situation became quite different. Modern science and technology has overshadowed the once advanced Chinese technology and China has been forced unto the path of modernization. Chinese modernization is the topic of **Chapter 10**. The path that has been trodden is apparently dominated by the adoption of modern science and technology. This can be seen in the three ma-

jor phases. But the modernization of such a unique and enduring culture cannot be as easy as a direct adoption. Given China's successful past, important elements from Chinese culture are extracted and suggested to be contributive to an alternative modernity. For China itself its modernization can only be a synthesis of its tradition and modernity. Before Western modernity Buddhism had no less impact, but Chinese culture had managed to handle that successfully by adaptation and assimilation. The way to meet the new challenge should be essentially the same. In terms of technology a new implementation of the embracing-controlling-stance in the Modern Age is urgently needed. If China could achieve this new synthesis, it would be automatically an important contribution to mankind.

The last two chapters deal with two specific technologies, medical technology and information technology. They have the same structure. Together they show how the embracing-controlling-stance may be applied to specific technologies. **Chapter 11** first makes a historical survey of modern medical technology. Its philosophical foundation is the mechanical view of the human body. Under this view modern medicine has made big progress. Advanced surgical technologies and pharmacy have improved and saved many people's lives. Therefore modern medical technology should be warmly embraced. But on the other hand the overdependence on modern medical technology has made people overlook other factors of health and the abuse of it has even caused more health problems than it actually cures. Further, recent advancement in medical technology, especially in the area of reproduction, has brought about fundamental ethical issues. How to use the technology in an appropriate way is a question worth considering. Similarly **Chapter 12** makes a brief review of the several-decade history of information technology first. People have been talking about an information revolution. Although it's debatable to claim that information revolution has a parallel scale with the Industrial Revolution, it does greatly improve automation and communication, which are actually two basic components of the Industrial Revolution. Perhaps only the so-called virtual world generated by software simulation is something new. In this information world made possible by computers a kind of degradation gradually shows up. Books are first turned into magazines and then magazine articles are turned into scattered multi-sentence paragraphs, containing frequent grammatical errors. Another aspect is the out-of-control of information. Under the principle of freedom of speech, all kinds of information are suddenly put on the universal internet and become accessible for everyone. The loss of organization and control represents the core of degradation. Therefore the need of control is more straightforward in information technology.

Part One
Alternative Modernity

"Modernity" is a rather vague word. "Modernism" has been used to refer to an art form in the 20th century. "Modern" is even used as the equivalent of fashionable. But in this essay "modernity" refers to a particular historical period and the thoughts, styles and institutions associated with it.

The Modern Age in the West is said in contrast to the Middle Ages or the medieval period. In the Middle Ages Christianity dominated Western life. The Christian dominance permeated every aspects of human life, people's world outlook, politics and everyday life. Life then could still be divided into sacred and secular, but apparently the former had the absolute upper hand. People's worldview was centered on the Bible. In politics the state was ruled by a monarch, but the power of the monarch had to be granted by the clergy. And God worship was an essential part of people's daily life. After centuries of development since the Roman period the Christian culture finally got into the state of decadence. The Modern Age just grew out of that decadence.

There was no clear boundary between the Modern Age and the Middle Ages. Rather, there was a big overlap between the two periods, with elements from both coexisting for about three centuries. The modern elements could be clearly seen as early as the Italian Renaissance. The thought at the core of Renaissance was humanism. Man was no longer regarded as an inadequate, ignorant and impotent being carrying an original sin, but instead an existence who through the mastering of thought and art could determine his own fate. "Independence of mind" was the brand of the age and a "complete man" was the ideal. The Renaissance spirit was perhaps best described by Hamlet's words in Shakespeare's play (*Hamlet* Act 2, Scene 2):

> What a piece of work is a man! how noble in reason! how infinite in faculties! in form and moving how express and admirable! in action how like an angel! in apprehension how like a god! the beauty of the world! the paragon of animals!

As Davies says, "Left to itself, humanism will always find its logical destination in atheism. But mainstream European civilization did not follow that extreme road." (Davies 1998: p. 480) Definitely, from centuries of Christian culture to atheism would be too radical. There needed to be a moderate path.

The Religious Reformation was that moderate path. Ever since Luther posted his 95 Theses the Western spiritual life hasn't been the same. Luther's new doctrine was that of "justification by faith alone." In other words, man could obtain salvation by interacting with God alone. In this way God and the Bible were preserved, but at the same time the clergy became redundant. Although looked from outside the Christian world this was just a reform, it's no less than a revolution from within. And in fact it's not merely a revolution of thought, but a political revolution. Political leaders grasped the chance to gain more

power. Different states shortly aligned with different religious camps and wars were inevitable.

"The Wars of Religion offered fertile soil for the fragile seeds of reason and science." (Davies 1998: p. 507) The Scientific Revolution next came into scene. Copernicus, Galileo and Bacon were the three heroes at the beginning. While Copernicus challenged the long held Christian geocentric worldview, Galileo and Bacon emphasized the two fundamental scientific methods: mathematics and experimentation. In a sense the Scientific Revolution was a result of the Renaissance humanism and the Protestant attitude. Although science revealed a totally new picture of the world than Christianity, I propose, it aligned itself more with the Religious Reformation than the Renaissance. It's not just because most of its foundation layers were as devout Christians as others, but because the concept of something like God is behind the scientific endeavor (cf. 9.1.1.4). Traditionally it's "the Great Clockmaker" and now it's the Grand Unification Theory. Unity and universality are built-in scientific pursuits.

The Enlightenment obviously built itself up upon the achievements of the Scientific Revolution. With mathematical methods the Scientific Revolution had demonstrated the power of human reason. The Enlightenment hence raised reason to a paramount place. Kant defined Enlightenment as "man's going out of his self-inflicted immaturity. Immaturity is the inability to use his own understanding without the guidance of another." Therefore, everyone already has reason as his potential faculty and the important thing is to use it *independently*. Human reason was deemed to have "natural light" and with this light all the darkness in the world could be enlightened. A little deeper reflection could reveal the problem with this kind of rationalism. Reason is apparently just one of the faculties of human mind. And it plays little or no role at all in many human activities, such as moral judgment and the creation of art works. Romanticism just emphasized the human experience that is beyond the scope of reason. But the dissenting voice of Romanticism soon was suppressed in the Industrial Revolution and especially its material success thereafter. The Enlightenment thought took root. Although Romanticism tried to resist several times later, rationalism dominated the stage.

The Renaissance, the Religious Reformation, the Scientific Revolution and the Enlightenment were mostly movements of letters, whereas in the Industrial Revolution the new ideas and especially the new science bore fruits. The Industrial Revolution featured in the invention of the steam engine and a bunch of power-driven automatic machines. With the invention modern factory was born. The machines required a large number of workers working together and a finer division of labor. Therefore a new production relationship came into being. So did the production motivation and target. Now the production was

mainly motivated by generating profit for a certain amount of capital, and it's targeted at the market. As long as it could gain profit, how to produce didn't matter; as long as the products could be sold on the market, what to produce didn't matter. These were capitalism and commercialism. At the beginning the technical inventions seemed to have nothing to do with science. Little Newtonian mechanics was used in the invention of the steam engine and other machines. But later science played a more and more important role in technical advances. Generally the Industrial Revolution deified science and solidified the Enlightenment thought. With the Industrial Revolution almost completed Western Europe was set to conquer and dominate the world.

The Industrial Revolution was an economic revolution. A corresponding political revolution occurred during the same period. The independence of America to some extent triggered a similar political revolution in Europe. The French Revolution shook the European social order and paved the way to liberalism and democracy. Before the revolution France, in fact the whole Europe was ruled by monarchs. The monarch had absolute power over the people, as vividly illustrated by Louis XIV's famous words "L'État, c'est moi!" Hence this kind of polity is called monarchy. In contrast democracy means the rule of the people. In a democracy the government should be constructed based on the will of the people and governs the society based on a clearly specified set of laws. Under this principle the particular form of parliamentary system with power balance was finally established. Universal suffrage and freedom of speech were later development.

We've briefly reviewed the major events in the cultural, economic and political realms during the Western modernization process, roughly in historical order. Now we may come back to the recent time. After over a century of domination Europe was finally eclipsed in the two World Wars. The center of world power shifted to the United States. Now the US is also facing unprecedented challenges: terrorism, financial crisis and the rise and competition of emerging powers, to name just a few. Since the Industrial Revolution Western intellects have started to reflect on Western modernity. Marx's *Das Kapital* was a prominent work in the early phase. The two World Wars made the reflection deeper and more comprehensive. The Critical Theory originated in the war period whereas postmodernism was a major philosophy and art movement in the post-war period. Now even the word "decadence" has been heard. As Barzun puts it: (Barzun 2000: p. xx)

> But why should the story come to an end? It doesn't, of course, in the literal sense of stoppage or total ruin. All that is meant by Decadence is "falling off." It implies in those who live in such a time no loss of energy or talent or moral sense. On the contrary, it is a very

> active time, full of deep concerns, but peculiarly restless, for it sees no clear lines of advance. The loss it faces is that of Possibility. The forms of art as of life seem exhausted, the stages of development have been run through. Institutions function painfully. Repetition and frustration are the intolerable result. Boredom and fatigue are great historical forces.

As history moves into a new Millennium mankind is standing at a crossroads. New transportation and communication technology has connected humanity as never before. Foreign goods and visitors can be seen everywhere. Enterprises are globalized. And more and more people are playing a more and more important role on the international stage. Mankind is facing many challenges, such as global warming, resource shortage and incessant cultural and political conflicts. But with the decline of the American hegemony it has a chance to build a new world order, an order in which reason still plays an important role, but feelings, emotions, imaginations, intuitions and insights are duly respected at the same time, in which universality is no longer held to be the sole principle, but diversity is also wholeheartedly encouraged, in which tolerance and cooperation are not just spread within a state, a nation, but also internationally, in which personal freedom is still regarded as a fundamental value, but knowledge, cultivation, vision and even some tastes are again deemed as essential parts of freedom.

The construction of this new world order has to be based on Western modernity, for the sheer reason that the West has led mankind into the Modern Age and Western modernity contains many values and institutions that should be inherited in this new order. But the problems that have appeared in Western modernity also make corrections or reforms necessary. The sources of some reforms can be found within the system itself, but in many cases we have to look outside. In fact a more accurate reflection on Western modernity can only be achieved when it is put in its historical and cultural context. The criticism from Western intellectuals has paid enough attention to the historical context. But after decades of comparative cultural studies the cultural context is also becoming clearer and clearer. In this way traditional Western thought and ideas from a different culture may contribute to this cause.

Facing the issues in Western modernity people have started to talk about alternative modernity. The alternative modernity theory was developed out of the Critical Theory, which in turn originated from Marxism. Since Marx Western intellectuals have launched various criticisms of Western modernity. The Frankfurt school played an important role. The Critical Theory they created and maintained not only brought the criticism up to the recent developments of Western society, but also greatly influenced the contemporary criticism.

Andrew Feenberg is a prominent advocate of alternative modernity theory. He was a student of Marcuse, and the latter was a key figure in the Frankfurt school.

Feenberg's alternative modernity theory is based on a constructivist theory of technology, which holds that technology is neither neutral nor autonomous, but undergoes social construction just like other institutions. This opens a space for an alternative modernity. By democratizing the technical design we could put technology well under control. I would call this approach a weak alternative modernity. In contrast I propose a strong one. Instead of trying to find an alternative within the framework of Western modernity I cast my sight onto the multi-cultural context.

However, Western modernity still has priority. Alternative modernity contains two components, modernity and alternative. Correspondingly the priority of Western modernity is reflected in two aspects. First, Western modernity should be treated as a *model* of modernity. The concept of modernity must be formulated on the basis of Western modernity. Second, Western modernity should be treated as a *reference* for alternative modernity. An alternative modernity must distinguish from Western modernity in non-trivial ways. Therefore we have three distinct concepts of modernity: modernity in general, Western modernity and alternative modernity. Alternative modernity is parallel to Western modernity and both are a special form of modernity in general. This is the static logical relationship. In terms of conceptual genetics modernity in general and alternative modernity are both derived from Western modernity. The two chapters in this part deal with the two components in turn.

The focus of this essay is on technology, but alternative modernity theory provides the framework within which technology will be discussed. In this part I shall set up a preliminary strong alternative modernity theory. Due to the limit of scope, the ideas brought up may not be supported by sufficient arguments. These have to be left for future development.

Chapter 1. Modern vs. Premodern: The Essential Features of Modernity

As we mentioned alternative modernity contains two components. First, an alternative modernity has to be *modernity*. So as the first step we must determine what modernity is, or the criteria of modernity. Second, an alternative modernity has to be an *alternative*. That means an alternative modernity must be different from Western modernity in some important aspects. As the second step we need determine in what respects an alternative modernity must be different from Western modernity. Both tasks have to be based on Western modernity. It's treated as a model in the first task, but a reference in the second. The tasks boil down to grouping the essential features of Western modernity into two groups: the first group that is also essential to modernity in general (hereafter the qualification will be omitted) and the second group that is peculiar to Western modernity. Distinguishing these two groups of features is a fundamental part of my modernity theory.

The essential features of modernity are extracted from the key events in the process of Western modernization. We may list the events as follows, with their key features in parentheses:

- Renaissance (Humanism, Independence of mind, Complete man)
- Religious Reformation (Private conscience, Justification by faith alone)
- Scientific Revolution (Mathematics, Experimentation, Unity, Universality)
- Enlightenment (Autonomy of reason, Reason as the paramount tool)
- Industrial Revolution (Mechanization, Specialization, Capitalism, Commercialism)
- Political Revolution (Democracy, Power balance, Rule of the law, Human rights)

It's safe to assume that these key events and features sufficiently characterize Western modernity. Taking a closer look at them we can find that a general idea was contained in all the events. That general idea was individualism. Individualism gave individual person the first priority.

In Davies' words: "The cultural interest in human beings, the religious interest in private conscience, and the economic interest in capitalist enterprise all put the individual centre stage." (Davies 1998: p. 483) We may look at each of the events in turn. The humanism of the Renaissance was an anthropocentric idea. And the independence of mind and the concept of a complete man were both about an individual. The independence was not just about being independent of the theocratic religious institutions of the Middle Ages, but of other people. A complete man could only be a single man. The private conscience of the Religious Reformation obviously also belonged to an individual. Faith was an individual property too. Science was originally a personal endeavor, and the Scientific Revolution culminated in Newton with his mechanical laws and the law of gravitation. On the basis of the success of science the Enlightenment emphasized reason, an individual's intellectual faculty. In the economic realm the entrepreneurship in capitalism certainly was also individualistic. Self-interest was glorified as a benign driving force. And finally democracy granted equal political rights to each of the individuals in a society, while human rights universalized some of the individual rights.

This strongly suggests that individualism is an essential general feature of modernity. In the Middle Ages an individual didn't have much value. What's most valuable was the Bible, thereafter came the clergy, then the monarch. A common person was at the bottom of society. On the contrary, in the Modern Age an average individual is put at the center of the cultural, economic and political realms. A cross-cultural comparison can provide more justification for this claim. Although there were important differences between Chinese traditional feudal society and the Western medieval society, they share some common characteristics. Chinese society was mostly irreligious (cf. 9.2.1.1), but people's mind was influenced by superstition and systematic feudal rules and regulations governed people's relations and manners. Corresponding to these rules and regulations there was strict social order. A subject had to obey the emperor, a son the father, a wife the husband. Even a younger brother had to obey the elder one. In general an individual was bundled in a web of ethical rules and regulations and political laws. Personal freedom was limited. In this case society had the highest priority, whereas an individual had much less value. As Chinese society is getting more and more modernized, the individual should also obtain more and more freedom.

Individualism is mainly related to spiritual and political affairs. It cannot cover all the characters of modern economy, especially the modern production mode. To make the essential feature set complete, besides individualism we have to add industrialization. The modern economy is an industrialized economy and the modern production is an industrialized production. Although

machines had been used in traditional workshops, they had never become as automatic, powerful and efficient as those that were invented in the Industrial Revolution. This new production method distinguishes modern production from the traditional one. This is the case also on the cross-cultural level. Technology had been well developed in the traditional Chinese society and China had been leading in a bunch of technical areas (cf. 9.1.2), but compared with modern technology traditional Chinese technology becomes primitive. In this sense we should include industrialization in the essential feature set of modernity.

Historically individualism and industrialization went hand in hand in most of the time, but logically they are mutually exclusive and complementary. Individualism doesn't imply industrialization. It's not reasonable to claim that modern technology and production mode necessarily follows from individuals being put at the center of value. The rise of modern science and technology requires a more complex historical context than just individualistic ideas and institutions. On the other hand, industrialization doesn't imply individualism either. In fact the first set of inventions in the Industrial Revolution was done before the French Revolution, when political absolutism still dominated Europe. And once industrialization started to happen in Western Europe, it can be implemented completely in a totalitarian state as the history of Japan and the Soviet Union showed.

In general individualism and industrialization are two *necessary* features to differentiate modernity from tradition. The former outlines the modern cultural and political realms whereas the latter the modern economic realm. I also propose that these two features are *sufficient* to distinguish modern from premodern societies. The arguments should demonstrate that main features of Western modernity are contained in these two general features and other key features of Western modernity are peculiar to it. The first half is the task of this chapter and the second half that of the next.

1.1 Individualism

When we take a general view of human history from the ancient time to the present we may find an overall pattern in terms of human relations. The place of an average person has been gradually lifted. In a sense individualism already existed in the ancient time. The ideal of the sage was the core of Chinese classical philosophy and a sage was no less than a fully realized individual. In ancient Greece there was even a form of democracy, in which important af-

fairs of the city state were decided by people's votes. But on the other hand in the time when Chinese classical philosophy was intensively developed human sacrifice was popular, and when free males voted in the ancient Greek assembly slaves were transported and sold at the will of their owners.

There were improvements in the feudal society. Human sacrifice was regarded as barbarous and slavery was commonly abolished. Human beings were no longer treated as animals. This in effect raised the human productive power and the economic status was greatly improved. However, in the feudal society people were still ruled by a monarch or an emperor, who had absolute power over the people. The thoughts, feelings and wants of an average person didn't count much. Their life and fate were at the disposal of the thoughts, feelings, and even whims of the monarch or emperor. Taxes were levied at will and services were demanded whenever needed. In Europe Christianity controlled people's mind and provided justification for the political order. Similarly in China a system of feudal ethical codes were developed out of the classical philosophy to maintain the social order.

Only in modern time was the value of an individual seriously considered. This was first embodied in the modern political thought. Although *Leviathan* was essentially a defense of absolutism, Hobbes first treated an individual as the starting point of political theory. The transition from a natural state of war, where everyone fought one another, to the subjection to a government, a monarch was decided by each individual and for the benefit of each individual. The crucial benefit for subjection was the protection from the monarch, the security. Political liberalism came into shape in Locke's *Two Treatises of Government*. At the core of liberalism was the concept of a social contract, according to which an individual granted some rights to the government for his own interest. A very important implication was that when the government behaved against the interest of the governed, thus broke the contract, the latter had the very right to rebel and throw away the government. At this point an ordinary individual was put at the center of the political stage. Liberalism culminated in *The Declaration of Independence of the United States of America* (cited from Norton 1988):

> We hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty and the pursuit of Happiness. That to secure these rights, Governments are instituted among Men, deriving their just powers from the consent of the governed, That whenever any Form of Government becomes destructive of these ends, it is the Right of the People to alter or to abolish it, and to institute new Government, laying its foundation on such

> principles and organizing its powers in such form, as to them shall seem most likely to effect their Safety and Happiness.

Political liberalism only covered part of individualism. Politics is about interpersonal relations, about an individual's place in a society. Political liberalism grants equal rights to each of the individuals in a society, so it's essentially equality. There are also other aspects of an individual. Even when an individual is free from political or social coercion from other people, she could still be under some kind of spiritual restriction: superstition, ignorance, bias, bigotry, fanaticism, let alone all kinds of Freudian subconscious complexes. The Enlightenment movement glorified reason for a reason. Reason was an effective cure of most of the traditional spiritual restrictions. Bacon demonstrated this in his *Novum Organum*, where four kinds of "idols" (those of the tribe, the den, the marketplace and the theatre) were revealed and rational methods were suggested to get rid of them. With reason Copernicus was able to topple the taken-for-granted Christian geocentric worldview and Galileo was able to challenge the long held Aristotelian theory of gravity. So the new scientific spirit no less liberated human individuals. While political liberalism liberated an individual from the coercion of political authority, science and reason liberated an individual from the coercion of spiritual authority. Science also declared independence from superstition, ignorance and bias.

Interpreted in this way, individualism seems to be able to capture the essential characteristics of Western modernity in the political and spiritual realms. Three key events in the Western modernization process, the political revolution, the Scientific Revolution and the Enlightenment have been considered. The Renaissance can be regarded as a spiritual individualism too. The Religious Reformation can be considered as having both the spiritual and political sides. On the spiritual side personal faith was liberated from the authoritative interpretation of the Bible. This is a form of spiritual individualism. On the political side secular political state was liberated from the clergy, a step toward the political liberation of the individual.

Having identified individualism as an essential feature of modernity, next we need to analyze it and put some qualification on it. We have shown that individualism can be divided into two kinds: political individualism and spiritual individualism. And equality is a central part of political individualism. So in the rest of this section we discuss equality, sociopolitical freedom and spiritual freedom in turn.

1.1.1 Equality

In a traditional society there always existed different levels or classes of people. They didn't have to be as different as the Indian castes, but different levels had different political rights and social statuses. The word "order" reflects this fact. When we say "social order" we mean what makes a society a normal, peaceful and harmonious one. But "order" also means a sequence where things are arranged one after another. Where there is difference there is normality, peace and harmony. We may say inequality was a norm in a traditional society. Discrimination against an individual could be based on a bunch of properties, such as birth, wealth, age, gender, race, religion, even physical traits.

The modern society has gradually changed this situation. In the political revolution birth and wealth were first abandoned as the basis of discrimination. The boundary between noble and common finally disappeared. But other kinds of discrimination still existed at the beginning. It's a little ironic that, while "all men are created equal" was written in the *Declaration of Independence*, a modern slavery exited in the United States, women were denied voting rights and religious sects were persecuted. These issues had to wait for later developments, particularly the civil war, the general suffrage and the civil rights movement. The ideal of modern equality is to eliminate all superficial features for personal evaluation that were once used to discriminate people.

But all this is about the *principle* of equality. The principle seems to be straightforward, but not the practice, as the affirmative action shows. The affirmative action in the United States is sort of a correction of racial discrimination. It tries to bring the number of members from a particular race in an institution into accord with the proportion of that race in the general population. For instance, if the proportion of black people in a state is 20%, then the black students enrolled in a state college should also be 20% of all students enrolled. A possible result is that some black students with lower scores are enrolled, while some white students with higher scores rejected. The question is: Does the affirmative action conform to the principle of equality? It does in a certain sense of equality, but not in others. White students have complained that the affirmative action is a different form of racial discrimination, a discrimination against the white people this time. For if they were not whites they would be enrolled with higher scores. This example clearly shows that equality has to do with fairness under a particular standard. Different standards may result in different states of fairness.

The sentence "All men are created equal" also needs qualification. All men are created equal in certain senses. In other senses no man is created

equal. In the most liberal state today a child's fate is still to a large extent determined by his parents. Even though it's not determined by the wealth and social status of the parents, the genetic traits, the education level and the skills of education of the parents still count a lot. As long as a society doesn't raise all children together in a common place once they are born, like the Spartan did, the parents' influence in education cannot be eliminated. Even in Sparta there were still differences among children, as different children were born with different qualities and talents. So selection was still necessary. Therefore considering the fate of an individual we first have different genes and conditions of pregnancy, then different early cares and educations, and after that different general educations and higher educations. As heredity and education essentially determine an individual's fate, this makes equality really complicated.

Following the equality principle a society could try to make things as fair as possible. First, the equal right to education is necessary. In this sense equality means equality of opportunity. This implies a tuition free education for all. A significant tuition without effective financial assistance would deprive many talented but poor students from receiving an appropriate education they deserve. Second, for the inequalities a society cannot avoid, such as those in talent, family education, physical properties the society could try to correct them through wealth redistribution.

Apparently there are many issues with wealth redistribution. An extreme case is the communist principle of "distribution according to needs." The problem with this principle is not just that people's needs are vague in many cases, but also that the principle greatly reduces the motivation to work. If the gain is based on a vague principle and no matter how hard one works the gain is the same, then why do people work hard, or even work? So the normal result is the lowered production and finally the decomposition of the commune as history has shown. Perhaps this kind of distribution is only suitable for a community of saints, but nobody is a saint in the strict sense.

Rawls's theory of justice is a social contract theory based on a thought experimental "original position" with "a veil of ignorance". Behind the veil of ignorance a person doesn't know anything about his social characteristics such as class position and social status, nor does she know anything about her personal qualities such as abilities, intelligence and strength. The person needs to make rational decision on what principle to follow in order to maximize her own prospects. The result is the difference principle: "social and economic inequalities are to be arranged so that they are […] reasonably expected to be to everyone's advantage" (Rawls 1999: p. 53). "Everyone" means everyone regardless of his characteristics. An implication of the difference principle is

that a person is not entitled to the benefits from his talents. This is counter-intuitive to many people. The veil of ignorance strips away every feature from a person except reason. Then do there still exist individuals? If even a person's talents are regarded as social properties, how far is this from communism?

Rawls's theory is certainly in line with a welfare society. In a welfare society a bunch of benefits are provided to anybody in need, such as food stamps, health care, unemployment compensation and pension. There are also issues here. While most industrialized nations including Canada, Germany and many other European countries already have a comprehensive welfare system, there have been hot debates as to what should be included in the welfare system in the US. This is a major battle field between republicans and democrats. The health care debate was the most recent.

My personal stance is that the central part of equality is that of opportunity, i.e., free pregnancy medical care, free child care and free education; social benefits for the naturally weak, such as disabled, old people and natural disaster victims are well justified; social benefits for ordinary people should be limited to the humanitarian very basic needs of life. Generally the society is responsible for granting each individual equal opportunity to realize her potential. But the individual is responsible for doing that herself.

1.1.2 Sociopolitical Freedom

Equality and liberty are two aspects of individualism. They both have an individual as the starting point. Equality is about an individual's place in the society and liberty is about removing social and other restrictions on an individual. In this sense equality and liberty go hand in hand. However, in a different sense there also exists tension between them. A too lax principle of equality could mean a hindrance to liberty. In the extreme case when equality is interpreted as identity there would be no liberty. Communism seems to be an approximation of this.

Liberty is about personal freedom. Personal freedom includes freedom in two aspects: sociopolitical freedom and spiritual freedom. In the sociopolitical aspect, a person is no longer an obedient member of a church, or a subject of a king, or even a property of his parents. She can make decision on her own life and determine her own fate. Sociopolitical freedom is a major fruit of the political revolution in the modernization process. It includes mainly freedom to vote and to be voted, freedom of property, freedom of speech and assembly, and freedom of religion.

The issues with sociopolitical freedom are trickier than those of equality. An inappropriate principle of equality may go against liberty, but an excess in liberty may go against itself. Equality is an interpersonal relation. Under any principle of equality a society is always equal. On the contrary, the center of liberty is a particular individual. Since people live in a society except the very rare cases and people's interests often conflict with one another, the liberty of this person may contradict that of another. So in the individualistic political theory there has always been the tension between an individual and the society to handle. Unconstrained personal freedom will definitely lead to destruction of the society and hence forfeit of personal freedom.

As depicted in the Western films, many people in the American West of the nineteenth century had to carry guns to protect themselves. This had become a rooted tradition which cannot be gotten rid of even in the contemporary society with well established laws and police. In fact carrying weapons is a fundamental right mentioned in the Constitution, because the United States was created by a revolt of the colonial people and weapons among the ordinary people played a crucial role for the success. Even today many people still think that weapons among the society is necessary to prevent the tyranny of the government, although the government has control of the military equipped with all kinds of most advanced weapons while the people have mostly handguns. Other arguments have also been formed to counter gun control maneuvers. One is that the police are not sufficient to protect the people, so when people have guns the crime rate could be reduced. A more straightforward argument is that carrying guns is part of a person's freedom, with which she may enjoy hunting and other sports. But the fact is, being the only country with widespread guns among society the US has the highest crime rate and people don't feel safe to walk on the streets during night in many cities. Mass murder events involving innocent people have happened again and again. Each time a hot debate concerning gun control appeared but shortly everything kept usual.

Mill tried to reconcile an individual with the society. In *On Liberty* he proposed the following principle (Mill 1989: p. 13):

> That principle is, that the sole end for which mankind are warranted, individually or collectively, in interfering with the liberty of action of any of their number, is self-protection. That the only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is to prevent harm to others. His own good, either physical or moral, is not a sufficient warrant.

With this principle a boundary is drawn clearly between the private and the public spheres. Only when harm is done can the society interfere with an individual's private sphere, otherwise it's none of the society's business. I

call this voluntary liberalism, because an individual's will is used as the final criterion. Mill's *On Liberty* was a milestone in the history of liberalist thought. It strongly emphasized social freedom alongside political freedom. With it freedom of thought, freedom of conscience, freedom of speech and freedom of assembly became as important as freedom from political oppression.

But the question is, does this principle based on an individual's will conform to the genuine spirit of personal freedom? This principle can be used to argue in favor of gun control, as wide spread guns in the society actually cause harm to people. What about pornography? According to some statistics the number of pornography websites in the US was at a time among the biggest in online businesses, and millions of people were addicted to internet pornography. Can we call this addiction personal freedom? If visiting pornography websites is totally a private matter, then what about prostitution? Prostitution involves a different party. Defenders may still say that the party involved willingly sells sexual service, keeping their eyes off from the issue of human trafficking as sex slaves. OK, if willingly selling sexual service still can be regarded as personal freedom, then what about willingly selling an organ, like a kidney? I believe a majority of people would think this last case immoral as it goes against human dignity. When the meaning of a person is in question how can we still talk about personal freedom? We have gradually slid down a slippery slope and reached an end we originally didn't intended. And all these cases conform to the principle of voluntary liberalism.

The latest development of the human rights movement should also be mentioned here. In a sense the notion of human rights is a result of liberalism, but it has universalist and egalitarian flavors. Human rights are rights of any human being, not of a citizen of a particular state. So it's an international concept. There are debates concerning what should be included in the fundamental rights of any human being. I just want to show here how the spirit may go astray when human rights are not qualified properly. The first example is about rights of criminals. Many human rights activists think that death penalty violates the criminal's fundamental right to life. So when it's obvious that a serial killer intentionally murder many people probably only for fun, he still doesn't deserve a death penalty. However, if the criminal has right to life, then what about those victims? They also have right to life, and are deprived of it by the criminal. There are hot debates concerning death penalty. Death penalty shouldn't be a way of vengeance in the sense of "an eye for an eye" (in fact in this case it can only be an eye for many eyes), but carrying it out appropriately is an effective deterrent to prevent similar things from happening again, hence in favor of people's right to life. A general principle of universal right to life cannot handle conflicting cases like this. Another thing is the treatment

of criminals in prisons. It seems to me some human rights activists would complain about any harsh treatment of prisoners. But a prison is built to punish people. When a prison becomes a vacation village, or a place for criminals to build connections so that they are in a better shape to break the law again, when human rights degrade to criminals' rights, no wonder the crime rate keeps high and prisons run out of place and need to be expanded. The second example is about rights of minors. The recently published book *Battle Hymn of the Tiger Mother* has brought about a hot debate about the education status in the US. Some people realize that the American education is too lenient, too permissive to the students. Teachers hesitate to punish students in the school being afraid of complaints from parents and parents hesitate to punish children at home because they are protected by law. Children are smart enough to take advantage of this. When they see a punishment is coming they could threat to call the police. The result is that the children can do whatever they want and the general quality of education slides. This is a consequence of expanding human rights to minors without any adjustment. The interesting thing is that right after Mill proposes the above principle he declares explicitly: "this principle is meant to apply only to human beings in the maturity of their faculties." (Mill 1989: p. 13) I'm not advocating that children should be educated with the ways described in the book. Activeness, creativity and free development are all important, but an appropriate amount of restriction and guidance are the guarantee. Generally speaking it's an advancement that human rights movement extends individual rights beyond borders, but it has to be careful about the scope of human rights.

1.1.3 Spiritual Freedom

Spiritual freedom is a different kind of individual freedom. While sociopolitical freedom is freedom from the society, the government, or other people, spiritual freedom is freedom from spiritual restrictions. Human mind can be roughly divided into the intellectual and the emotional sides. The intellectual side is about beliefs, knowledge, vision and the emotional side is about drives, feelings, tastes. Intellectual restrictions include superstition (unfounded belief), ignorance (lack of knowledge), prejudice (belief grounded on partial or one-sided knowledge), etc. Emotional restrictions include low interest (lack of high drives), passionlessness (lack of drive), irritability (easily annoyed), etc. So spiritual freedom can also be divided into intellectual freedom and emotional freedom. The former is freedom from intellectual restrictions and the latter freedom from emotional restrictions.

Reason and science are powerful tools to remove intellectual restrictions. Logic and evidence can reveal that a superstition is unfounded and a prejudice one-sided. Science has made many discoveries of the world and greatly expanded human knowledge. Therefore reason and science are indispensable for spiritual freedom. With their intellectual victory over superstition, prejudice and ignorance of the past and the associated material victory over nature, reason and science have been put on the sacred altar for people to worship. And there have always been many loyal defenders around them. If anybody dared to point his finger at them, those defenders would immediately jump up and launch a counterattack. The counterattack doesn't have to be fierce. Normally after the defenders call the offenders "irrational" or "superstitious", the former may think they have a victory. Only in the recent "science wars" things started to get a little complicated.

It has long been held that reason and science are the only path to truth, the scientific world is *the* world, and only science is powerful to lift mankind out of the dark ages of the past and able to promise a prosperous future. But a little deeper thinking makes us suspicious. Reason is just one faculty of the human mind, then how can it be so dominant? There are many things in our life that have little or nothing to do with reason. Most part of the realm of art and a major part of the realm of morality are beyond the scope of reason. When one is awed by a photo or moved by a piece of music, she just feels it, but cannot tell the reason. She even cannot find the words to describe the feeling itself. We may form arguments in ethics, but the premises of the arguments have to be based on intuition. Ethics is about what one should do. If everything could be deduced from facts then there would be no ethics. If reason cannot cover everything that is important to human life, science has even a less scope. Reason and logic are just part of the scientific principles, empiricism is another. And in the strict sense science also requires quantification and universality. Empiricism greatly shrinks the scope, because there are many things that can be argued but have no empirical evidence as defined by the scientific method. Psychology provides a good example here. When awake everybody has intuition about his consciousness, and reason doesn't seem to be able to function without consciousness, but when asked to prove the existence of consciousness in the scientific sense of proof we have to keep silence. Freudian psychoanalysis has well-formed logic within itself, but it has been denied by many people the status of science because there is no satisfying empirical evidence involved. If we add quantification and universality, then not only all the social sciences should be excluded, but even natural phenomena such as the weather of a certain place. Universal laws are extremely difficult to formulate in such complex systems.

Positivists tried to purify human knowledge by identifying and throwing away all kinds of "metaphysics," but only ended up revealing the limited scope of science. Kuhn's *The Structure of Scientific Revolutions* started a serious endeavor to dethrone science. Before science was pure, detached, objective and accumulative but hereafter it became theory-laden and revolutionary. In the postmodernists' eyes science is just one narrative of the world among many others possible. The environmentalists and feminists even accuse science of being aggressive, dominant, and the worst word associated with science is "rapist." Some of the attacks on science in the recent science wars may turn out to be too excessive. But one thing is for sure, we need to reevaluate science's place in human life. And this is closely related to spiritual freedom discussed here. If one insists that reason is the only tool useful and science can provide knowledge about everything in the world and turns a blind eye to any criticism in this respect, he may be restricted by a new form of superstition, prejudice and ignorance.

Historically science grew out of philosophy. They both share reason as an essential tool. But besides reason science added mathematics and experimentation, whereas philosophy kept intuition and insight. Here is where they diverged. Mathematics and experimentation can be applied well to many phenomena. These belong to areas where science is successful. But beyond those areas we still need philosophy to obtain knowledge. Even with philosophy added we still can only cover the intellectual side. As we move to the emotional side art becomes necessary. Art is not restricted by reason and logic, so it's a better embodiment of spiritual freedom. Whereas on one end science emphasizes reason and universality, on the other end art emphasizes imagination and uniqueness. A great scientific theory needs to cover a universal area and can be universally proved. On the contrary a great art work has to be unique and imitation immediately nullifies the value. Philosophy stands in the middle. Although philosophy needs logic in most cases, insight is more important. A great work of philosophy needs to bring up new issues, a new vision, but the resolution of those issues is not as important.

Spiritual freedom needs all three areas. Reason without insight may be still biased and reason without imagination may be too static. But on the other hand, we cannot do away with reason either. Otherwise we could slip back to the dark ages. For insight without reason will be suspended in the air and imagination without reason could become really blind, even crazy. To borrow Nietzsche's words we need to have both the Apollonian and Dionysian spirits and keep a good balance of them. In fact Western modernity doesn't lack the realization of this ideal. The Italian Renaissance had much focus on a "complete man," with da Vinci as the icon of the age. His interests and

achievements spread to over a dozen fields in all the three areas of science, philosophy and art. Many historians think Goethe was the last true polymath. He was mainly a poet, playwright and novelist, but also had achievements in philosophy and science. In the current age of information explosion, the ideal of a complete man becomes impossible to realize. But with the rise of interdisciplinary studies it's still possible and very beneficial for a person to get involved in fields crossing the three areas.

Da Vinci was a Renaissance man and Goethe was a key figure in the Romantic Movement. With the dominance of reason and science humanism and romanticism were rejected from the cultural main stream. And in voluntary liberalism an individual's will is put at the dominating place. In the US we often hear people say, "America is a free country. I can do whatever I want." However, personal freedom probably has more to do with what one wants to do rather than to do what one wants. Under the rule of reason and will combined, many social phenomena today are easy to understand. It won't be a surprise when we find that the icons of the current age are computer programmers, popular singers and sport players.

When we take individualism as an essential general feature of modernity from Western modernity, we have to make careful qualifications and modifications. We have shown in all the three aspects of individualism, that is, equality, sociopolitical freedom and spiritual freedom, there exist issues in Western modernity. The case is the same with the other general feature.

1.2 Industrialization

Individualism interpreted as the combination of equality, sociopolitical freedom and spiritual freedom captures the essential concepts and ideas in the Renaissance, the Religious Reformation, the Scientific Revolution, the Enlightenment and the political revolution, which were the major cultural and political events in the Western modernization process. To make modernity complete we have to consider the economic realm too. There are also essential differences between the modern economy and the premodern one.

In the primitive societies people made a living by taking things directly from nature, by collecting fruits from plants and hunting animals. This is the hunter-collector stage. Then came the agricultural revolution, in which people started to cultivate some selected plants and raise some selected animals. This ushered the second stage of economy. Human beings have been using tools

since the very early time. At the beginning tools were mostly weapons for hunting animals and fighting enemies and utensils for daily life, such as cooking and sewing. But later on complex tools were invented and they spread to the areas of housing, transportation and production. According to the material used in the tools historians also divide the ancient history into the Stone Age, the Bronze Age and the Iron Age.

With the Industrial Revolution the history of economy moved into the modern stage. The hallmark of the Industrial Revolution was the invention of the steam engine and other power-driven machines, mainly for spinning and weaving at the very beginning. But all kinds of engines and machines were invented later. After the steam engines there were internal combustion engines and electric motors, and recently nuclear powered engines were also used in power plants and the military. And machines have spread from production to daily life. Machines have since long dominated not only the scene of a factory, but also human transportation and the household. Take a look around our houses. There are cars, washing machines, vacuum-cleaners, refrigerators, stoves and all kinds of cookers, clocks, telephones, radios, TVs and computers. A modern life is impossible without these machines. Engines and machines are just the center of the modern economy. There are also many other features resulted from or related to them. Davies lists about "a dozen elements of 'proto-industrialization' that must be taken into consideration," and "they include farming, mobile labour, steam power, machines, mines, metallurgy, factories, towns, communications, finance, and demography." (Davies 1998: p. 679)

Compared with the premodern economy we may find the following characteristics of the modern one:

1) **Relocatable sources of strong power**: In the premodern society the sources of power included mostly humans, animals, wood, wind and water. Humans and animals could be easily relocated, but their power was very weak. Burning wood was mostly for heating. Wind and water mills were used in production. Although their power was much stronger, they could not be relocated from the wind paths or rivers. Also wind is not stable. And rivers are seasonal. This state greatly changed in the modern economy. Fossil fuels play a pivotal role. The steam engine uses coal and the internal combustion engine uses products from petroleum, and in rare cases natural gas. Fossil fuels can be easily transported. But with energy conversion, electricity provides a better way to transfer power. Electricity is also a clean power, so it's the most widely used, especially in the offices and households. These days with the depletion of fossil fuels and the global warming people are paying more attention to the sustainable sources of energy, including solar and nuclear energy, and water

and wind again. In general the modern sources of power are much more transferable, more stable and stronger.

2) **Wide-spread use of automatic machines**: Machines have since long been used in the premodern society. And there even existed a certain amount of automation. There was an automatic machine to pulverize rice at a water mill in China. But with the limited power source automatic machines couldn't be well developed in the premodern society. Most of the tools were still driven by people and animals, so there couldn't be much automation. Things are different in the Modern Age. In fact the first several machines invented during the Industrial Revolution were automatic spinners and weavers. In using these machines people just needed to monitor them and do limited amount of auxiliary work. All the rest were taken care of by the machines themselves. While the strength and stability of power are the basis of the automation of machines, the transferability of power is the basis of the prevalence of machines. Today machines have permeated all areas of production, office work and daily life.

3) **Much finer division of labor**: Life was simple in the premodern society and production mostly circled around basic needs. The number of professions was very limited. Besides work in the fields there were also some handwork professions, such as the shoemaker, the tailor, the baker, the butcher, the carpenter, the blacksmith, the doctor, etc. A doctor in a premodern society could probably treat all kinds of diseases. But today even dentists are divided into different professions. When you do a fill you see one dentist, but if you also need to have a tooth pulled you have to see another. On the one hand a finer division of labor was the result of the growth of professional knowledge. In the past knowledge for a certain profession was limited, so a person could probably grasp the whole area. But as knowledge grew, sooner or later it exceeded the ability of a single person. When that happened, the area had to be divided. On the other hand more efficient transportation and expanded market also made a finer division of labor possible. A small town or village didn't need many shoemakers, so a division was not that easy. But today a pair of shoes may be produced by many people, even in several different countries. It's possible due to the scale of the production.

These three features seem to be able to capture the essence of industrialization, while other features are derivative. Among the other features Davies lists, mines and metallurgy are required by the new power sources and machines. Mobile labor and factories are the direct results of the new mode of production with machines. Towns and demography are the indirect results. Finance is required by the new mode of production. The development of communications results from an expanded world. And with the economic history entering a new industrial stage agriculture is also industrialized. There are other things

not mentioned. Modern technology which is associated with science certainly is another prominent feature. But as we will discuss later, modern technology may not as different from premodern technology as some people thought, so it's not in a position to bear the essence of modern economy. Features like synthetic material also seem to be peripheral, although they are unique to modern economy.

The concept of information revolution deserves separate consideration. People talk about an information revolution in parallel with the agricultural and industrial revolutions. Computers stand at the center of information revolution. They differ from ordinary automatic machines in that they have software. Software consists of programs which can be easily reconstructed. So flexibility is the central feature. But the question is, does this kind of flexibility deserve the name of a revolution parallel to powerful automatic machines in the Industrial Revolution? This concept of information revolution is to a large extent based on Artificial Intelligence (AI). A really intelligent machine would be essentially different from an ordinary automatic machine. An automatic machine could also be flexible. It just needs an external entity to rewire its hardware, like a programmer reprogramming the software. But it's easier to implement automatic flexibility in the software than hardware. This is where AI can furthest get with a computer. For instance, in a neural network the node coefficients can be changed automatically, but the propagation algorithm is still the same. Genuine intelligence would require flexible flexibility. When a human being learns things she can at the same time reflect on her learning and adjust the learning strategy. Reflection is where the mystery is and it's beyond software. A digital computer is not a brain anyway. By obstinately and blindly denying human consciousness one cannot make his artificial toy more intelligent. It's essentially just an automatic machine.

In the three features above the first two may be combined. Power doesn't make much sense by standing on its own. It's used to drive machines anyway. So we may have mechanization and specialization as the two essential features of industrialization. And in the following subsections we discuss them in details.

1.2.1 Mechanization

Machines make production more efficient and life easier. Higher efficiency is based on stronger power and automation. In the premodern society there were also spinning tools and weaving machines, but those machines were driven and operated by human beings. The power of a human body is limited and it

cannot do work very quickly. In contrast the spinning and weaving machines invented at the beginning of the Industrial Revolution were able to do the work much more efficiently. Stronger power could drive more operations at the same time and automation reduced human interference and therefore things could be done faster. Thus the first influence of modern machines upon human life was to move work from a traditional household to the factory. The second was upon transportation. Locomotives on a railway suddenly could bring a person hundred miles away in a day, which had never been dreamt of before. Airplanes then could conquer the distance much better. At the same time cars made efficient transportation available in the ordinary private life. And with new communication techniques, telegraph, telephone, radio, TV, and most recently the internet, the world has been made smaller and smaller. The concept of an "Earth village" has become close to a literal reality. In addition, there was the household revolution with all kinds of household electronics.

Behind the glory of modern machines we should also cast our sight on the dark side. The first thing is **the obsession with machines**. The use of cars in an ideal American life provides a good example. An ideal American life includes a big house with a garage. Both the husband and the wife have their own cars, which take them from the stairs at home to the building of work and back on each working day, and to the shopping mall during weekend. So the American life is often called "a life on four wheels." Certainly cars are only one type of the machines people are obsessed with. Clothes are washed and dried with automatic machines. Food is cooked with automatic machines. Brooms are replaced with machines. Even ladders are replaced with Caterpillar machines. When machines are excessively used, people become obsessive. In many cases it seems that doing a work by hand is more convenient than using a machine. And there don't lack satires of this kind of situation. The film series *The Gods Must Be Crazy* hilariously put the modern and the primitive side by side. There is a shot in the film in which a man drives his car to drop a letter into a postbox across the street and then back. A more funny satire of American life is a picture which shows people ride on an escalator to get to a gym upstairs to exercise.

Then comes **the dependence upon machines**. In the past a vendor could make multi-digit calculations by heart. With the invention of the calculator fewer people can still do that. These days primary school students have even learnt to write programs to do their homework. When a patient goes to the hospital, before she could see a doctor she is asked to do a blood test, an ultrasonic scan, or even an X-ray. In this internet age a new type of disease even appeared which is called internet addiction. Millions of people spend hours daily on the social networks to report their trivial everyday life. Some say

they just cannot stop doing that even though every once in a while they are bored. And if they were cut from the internet for just a few days they would feel depressed. Children have been growing up in a virtual world constructed with movies and video games, and once they get into the real world they don't know how to behave. One might wonder how long a modern man could survive when cast away onto an isolated unmanned island. Robinson Crusoe probably has better chance of survival. There is a movie titled *Cast Away*, but the hero survived still with the help of many modern items. Machines are built to serve people, yet now people seem to be controlled by machines.

And finally there is **the environmental print of modern machines**. Premodern machines with their natural power and easily decomposable material had an impact on the environment that can be handled without much effort. Wind and rivers are part of natural processes. Wood and iron decompose in a short period of time. On the contrary modern machines are driven by fossil fuels and made of materials that will hold for a much longer period of time, such as plastic, glass and other synthetic materials. Certainly fossil fuels were formed also in natural processes, but first they were formed in a much longer time span than they are mined now, and second the formation of fossil fuels was often accompanied by geographic and climatic disasters. Now we are mining them out at a much greater pace and burning them out in a much shorter period of time. Simple intuition points to disturbed natural processes and environmental disasters. In fact global warming may be just part of the problem. If the temperature evenly rises by a couple of degrees, that would be a smaller problem. But what we are seeing now seems to be disturbances and irregularities of weather, which is worse.

Here I'm not advocating that we should get rid of all the modern machines and go back to water and wind mills. By listing mechanization as an essential feature of modernity I admit that modern machines are indispensable to modernity. But as all the three features in individualism we should also put qualifications on mechanization. We should use those machines, but at the same time we should treat them as tools and use them consciously and wisely.

1.2.2 Specialization

As mentioned above, the expansion of knowledge and the material world made specialization both possible and necessary. The expanded market integrated the formerly isolated professionals so that they could divide or further divide the labor among themselves. And the expansion of professional knowledge made division of labor necessary, because the knowledge of a whole area later

exceeded the ability of a single person to grasp. Hence a previous profession was divided into separate sub-professions. Specialization certainly benefits the special fields, and when the integration of different fields is well organized the general profession also benefits. When the energy of a single person is focused on a smaller field, obviously she has better chance to dive deeper into the field. Hence the knowledge of that particular field is more likely to be advanced. This has been demonstrated by the recent scientific researches. A natural philosopher in Newton's age could be involved in all the major areas of research, but today there are hundreds of scientific fields and very likely a scientist only specializes in one of them. Due to this the traditional major areas have been greatly developed.

With the use of machines the production process becomes more complicated. A single person can only handle a smaller part of it. The division of labor gets finer and finer and people also become more and more specialized. The invention of the assembly line provides an excellent case of how the division of labor can be well organized. In an assembly line the whole production process is divided into a sequence of small sets of operations, and each worker is responsible for only one of them. This has significantly improved the production efficiency. The reasons may be found in two respects. First when one worker only performs a single set of operations the transition effort across different sets has been saved. And second when a worker is focused on the same set of operations she has a better chance to improve skills for the particular job. Certainly another benefit from an assembly line is that the products come out evenly. The key is to divide the production process into sets with similar amount of work and still have an integrated whole.

Specialization benefits the profession and the production in most cases, but it's not true for individual professionals or workers. It narrows a professional's knowledge and degrades a worker in the production. Chaplin's film *Modern Times* vividly illustrates the latter. When a worker's only responsibility is to wrench two bolts, he is basically turned into a part of machine. It's symbolic with the hero's body sandwiched between the giant geared wheels. The case is similar with the professionals. It's probably sad when a medical expert only knows how to interpret X-ray sheets. And narrow knowledge in the research area often hinders creativity. Creativity requires abnormal angle of view and knowledge from a different profession is more likely to offer that.

The rise of interdisciplinary research could provide a way to alleviate the negative effects of specialization and give the researchers a chance to balance deeper knowledge of a particular field and comprehensive knowledge of a wide area. In an interdisciplinary research project, experts from different fields, sometimes quite different fields, work together to achieve a common

goal. In the cooperation each member has a chance to obtain knowledge from different fields. And due to the common goal one could probably find knowledge and ideas from other fields that are related to her own research.

And why can't a single person practice more than one profession? It's impossible for a contemporary person to become a da Vinci or Goethe, but it's still possible for her to master more than one field. Some statistics shows that on average an American has three professions in a life time. This is really dynamic. It's very normal for a person to get a new degree in his middle age in the US. Both the profession and the person benefit from this.

A brief summary of the chapter is appropriate here. In this chapter we've identified individualism and industrialization as the two essential general features of modernity, based on a brief historical study of the major events, concepts and ideas that occurred in the Western modernization process. Individualism is divided into equality, sociopolitical freedom and spiritual freedom, and industrialization into mechanization and specialization. The general claim is that these features are both necessary and sufficient to capture the essence of modernity. The necessity seems to be more straightforward and doesn't need much argument. The arguments for the sufficiency in this chapter are based on discussing each of the key features of Western modernity. Arguments in the next chapter will further support the sufficiency claim. When discussing each of the essential features we identify for modernity we also showed that each needs to be carefully qualified when taken from Western modernity. Modernity theory is very complicated. I am fully aware that this is only a framework and more arguments are needed. But for the discussion of technology, which is the central topic of this essay, a framework of modernity theory should suffice to serve the purpose.

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