Renewing the Progressive Contract with Posterity: On the Social Construction of Digital Learning Communities

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Author's Note
Acknowledgments

1:

> To educate educators! But the first ones must
> educate themselves! And for these I write.
> Nietzsche, 1875 [Note 1]

Introduction

2: Consider interactions between information technologies and educational practice as these play out in the fullness of time. Some events take place in a present tense that marks a short duration -- days, w eeks, months, perhaps a year or two. Others unfold in a prolonged process that spans a long duration -- decades, generations, even centuries. Over such a long duration, innovations in information technologies are interacting with new educational practices to bring about significant changes in human experience. As actors in that drama, educators must determine the human worth of those changes through the character of their practice.

3: Some critics bemoan the sweep of historic change and wish it could be blocked. Within education that is neither feasible nor desirable. Around the world, a remarkably ubiquitous educational system works well for some and poorly for others. Its elitism and class bias is global, a structural feature of the educational system built over the past four centuries. Educators designed the traditional system to make optimal use of a powerful information technology, that of printed text. In our extended present, the means of communication available to educators are changing rapidly, and educators are now having to determine what they will accomplish with those changing conditions. This essay raises potentialities inherent in the present situation to the level of explicit reflection in order to facilitate their social construction.

Technological Empowerments

4: Prediction anticipates what will happen in the future. Observation notes what is happening in the present, a present which may extend from the recent past, through the immediate now, to well into the future. Let us observe three things that are happening around us at a rapid pace in our extended present. First, people are converting all the contents of all the world's cultures to digital form, making the results available to any person at any place at any time. Second, people are gaining flexible command of multiple ways to represent information, simulate interactions, and express ideas, extending the reach of intelligence, altering the spectrum of civilized achievement, and lowering thresholds to cultural participation. Third, people are externalizing diverse basic skills -- to calculate, to spell, to remember, to visualize, to compare, to select -- into the digital tools with which they work, making practical mastery of such skills, once an outcome of education, increasingly a given at its outset. As these changes become evident in practice all around, educators sense that the spectrum of pedagogical possibility alters significantly.

5: To make a shift in the spectrum of pedagogical possibility clear, consider the history of architecture in the hundred years from 1850 or so. Until that time, throughout history and across cultures people simply did not build tall buildings except for a few towers for specialized ceremonial and military purposes. Then a series of innovations occurred, for reasons quite extraneous to the will of architects, that made unprecedented structures feasible. With new materials like structural steel, reinforced concrete, and plate glass, with new techniques for managing water, heat, light, and air, as well as novel ways of moving people, these unprecedented structures proved so humanly habitable that specimens of them have been built the world around, with great variations of form and function, and with diverse triumphs and failures on all sorts of measures -- social, structural, economic, and aesthetic. The new building technologies did not determine, in a strong sense, how any particular city would look, but they did open a wide new spectrum of architectural possibility. Within the range of this possibility numerous cities have developed imposing skylines like New York's, and even Paris, by explicitly adhering to traditional building codes in its central sections, reflects through its conscious restraint one of the possibilities of the new architecture.

6: Digital technologies are for education as iron and steel girders, reinforced concrete, plate glass, elevators, central heating and air conditioning were for architecture. Digital technologies set in abeyance significant, long-lasting limits on educational activity. Consider how this change in possibility occurs through the three key developments in our extended present noted above.

7: First, high-speed wide-area networks linking ubiquitous computers to copious digital libraries transform the cultural conditions under which educational interactions take place. Traditionally, the school and the classroom have been places where teachers and students are isolated from the general culture and where information and ideas have been relatively scarce -- the textbook is a meager selection of what a field of knowledge comprises, a skilled teacher is a bundle of ignorance relative to the sum of learning, and a school library a sparse collection at best. Networks reaching through the school into the classroom and to the desktop are ending the isolation and substituting a rule of abundance for that of scarcity.[Note 2] Such a new rule is not without its pitfalls, but to cope with these we must recognize that it is a new rule, deeply different from the old. In our extended present, the educational problem changes profoundly, shifting from stratagems for disbursing scarce knowledge to finding ways to enable people to use unlimited access to the resources of our cultures.

8: Second, new media alter the ways of knowing and the opportunities for participating in the creation of knowledge. Multimedia, and its extension in virtual reality, is not merely a glitzy vehicle for edutainment hype. It is an epistemologically interesting development in our culture. For the most part, the work of thought has seemed located primarily in the manipulation of language, with mathematics and logic through their formal symbolization seen as extensions of more everyday linguistic forms. Multimedia make it increasingly evident that the work of thinking can take many forms -- verbal, visual, auditory, kinetic, and blends of all and each. Of course, it is not the case that non-linguistic media are themselves new. Rather their status as serious means for creating knowledge is rising considerably. Knowledge consists primarily of cultural resources that people can store and retrieve on demand, as the need for it arises. Written, especially printed, media have long had a privileged place in education because they were easy to store and retrieve to suit the needs of users. Work in other media tended to exist in performances and monuments, which did not suit the strategies of random access. Multimedia changes that condition. It subjects a far wider range of communications to the

full rule of random access, changing the repertoire of resources that people can store and retrieve effectively and use on demand to serve the needs of disciplined thought and inquiry.[Note 3] People can use digital media both to acquire ideas and to express their thoughts in these diverse ways. As a result, educators will find it increasingly difficult to favor the linguistic modality over all others and they will need to broaden the norms of academic excellence.

9: Third, digital technologies expand personal potentialities. Distributed processing and ubiquitous computing may or may not aggregate into artificial intelligence in the strong sense, creating a species of machines that think in a significant way. But they are clearly coming to function as a means for augmenting intelligence with respect to our human intellectual skills. Word processors warn of anomalous spellings as they occur; spreadsheets allow anyone to perform complex calculations quickly and accurately; and databases permit those with good memory or bad to manage information sets that neither could handle on their own. All sorts of more specialized tools greatly lower the skill levels needed to participate effectively in wide ranges of cultural activity. Precision and exactness may become trivial proficiencies because getting it right will be easy, provided one doesn't get it wildly wrong through some accidental error. With regard to such accidental, but sometimes very portentous error, the ability to estimate and guess approximate results, traditionally an educationally suspect knack, becomes an increasingly prized skill. Thus educators are sensing that changes in information technologies can deeply transform the hallmarks of having acquired a decent education. Established answers to the question -- What knowledge is of most worth? -- may not pertain under the conditions of learning and knowing that emerge with the digital augmentation of human intelligence.[Note 4]

10: Digital libraries, multimedia, and augmented skills change the limits of educational practice. This proposition is not a prediction, but an observation about the potentialities inherent in communications innovations taking place in our extended present. The basic proposition here is not so much a normative argument that educators should, for one or another reason, adopt the proposition that these three developments are empowering the transformation of educational activity. Rather, the proposition is both more factual, although tentative. We are there, it seems. As educators encounter the changing conditions of communication under which they work, they understand those changes to involve a profound alteration in the spectrum of pedagogical possibility that results from long-term developments like digital libraries, multimedia, and augmented skills.

11: As educators experience changes in the communications constraints, they understand that these developments open the existing educational system to new possibilities. Individual educators may or may not welcome that condition, but critic and evangelist alike sense that the new conditions open things to significant change. The new conditions, however, do not determine what will emerge. Educators are determining what emerges through the social construction of digital learning communities. Educational structures from Kindergarten through graduate schools and adult education are increasingly in flux. Structures are wrenching open to change; but the course that change can and should take must be determined through the interplay of effort by many different groups. To understand such an interplay let us reflect on the dynamics of social construction.

Processes of Social Construction

12: In recent decades, American educators, especially those ensconced in schools of education, have relied heavily on linear flow models for improving educational practice. Such models make most sense in managing large-scale civil engineering projects or the development of new or improved products for a variety of mass markets. Researchers discover, be it by serendipity or system, valuable properties or techniques. Developers prepare them for the market, ensuring that they are tested and validated for performance, safety, and cost. Management allocates capital to the innovation and develops both production lines and distribution channels. Aroused by advertising, the public finds itself enjoying the benefits of nylons, scotch tape, and Prozac. Variations on this theme of linear application abound -- a causal flow moves from the origination of an idea to its elaboration in a plan that provides the specifications controlling the work of implementation, which in turn is followed by the evaluation of results through market returns or stipulated performance measures. This model has great simplicity and people use it to describe diverse forms of activity in technology, science, medicine, industry, government, war, and education.

13: Albeit simple, this model is not always sound. Historians of technology have been finding more intricate models necessary to make sense of the way that complex technical systems develop. Contemporary telecommunications has not arisen through a simple linear flow from Alexander Graham Bell's patent for the telephone. As a technical system, the telephone required many different people, working at different times and places through different organizations, to solve many different technical problems. It resulted through a distributed accomplishment by diverse people and groups who understood the technical potentials of an emergent telephone system in similar, parallel ways. Further, the emergence of the telephone as a social system required all sorts of people to form understandings of how to integrate use of it into the daily conduct of their lives. Some uses worked, others did not. Slowly, from many trials and differentiated actions, the telephone developed as a system in use from an odd device to a ubiquitous resource in all aspects of everyday life.[Note 5] Virtually every major innovation arises through such many-sided efforts. Confronting such complexities, historians of technology are increasingly displacing the model of linear flow with one of social construction, using the latter to show how major developments arise from independent actions by numerous people, with those actions cohering into a significant development because they are based on shared understandings of the potentialities implicit in the historical processes underway.[Note 6]

14: In deciding what to do with changing conditions, educators will engage in the social construction of a new educational system, one that will come about through a diversity of innovations taken here and there by people and groups that share, to varying degrees, a common understanding of what potentialities arise in their world of practice with the new technologies.[Note 7] This proposition may sound amorphous, but it will, if we stick with it, lead to a clear sense of what is to be done. Let us remember Aristotle's wise caution to seek "precision in each class of things just so far as the nature of the phenomena admits."[Note 8] The class of things here in question is the shared comprehension of possibilities arising through the use of information technology in education. We aim to grasp those possibilities in thought and action. In preparation, let us first separate ourselves from two frequent misunderstandings of them.

15: A common response to changing conditions, whether in education or other domains, is one of passive reaction that arises with the failure to perceive that any new possibilities arise with the changes. The classic instance of this reaction was the way in which early

printers crafted books that looked exactly like illuminated manuscripts. Passive reactions attach a timeless necessity to arrangements that are historically contingent. Passive reaction by educators amount to an inert effort to employ new information technologies to make the existing educational system work better, without significant changes in the structural features of that system. This course is fraught with ironies. Applying new technologies to current procedures, expecting them to work better but to remain essentially unchanged, does not lead to significant improvements. Rather, it forces fundamental change from within, without providing a vision of where that change should lead. In this way, educators risk being caught unawares in a cascade of unexpected innovation. We can do better in our extended present by recognizing that the task facing educators is to reconstruct the whole system in ways that will allow it to use new communications resources to overcome the inherent, structural deficiencies of the current system.

16: To grasp the opportunities inherent in changing conditions, educators need to adopt an active course based on their sense of potentiality for education, but they cannot overly plan that course. The second misunderstanding lies in a compulsion to be unduly specific about the possibilities. As we have implied above, reconstruction of the whole educational system is a supremely complicated process, one that will not come about by promulgating a neat plan and implementing it straight away. As a human experience, education is both an intensely personal process that unfolds over twenty years or more of an individual's life and a ubiquitous social operation that involves billions of persons the world around. It is so impossibly complicated that educators cannot conceptually plan or predictably implement a reconstructed system. They can, however, shape an emerging system over time, effectively constituting key features of it through a process of social construction, if they develop a concerted sense of shared directions. Coherent historical change wells up from many different acts that move parallel in time, spontaneously coordinating around an understanding of possibilities, at once emergent yet shared. Educators will best define the pedagogical opportunities arising with changing conditions by concerting independent actions, by developing shared understandings and purposes, by crafting a new common sense of where they stand and what they can do.

17: This essay is an attempt to articulate from the field what such an emergent common sense might be. It is an act of reflection on practice, an "interpretation from within," as the great Spanish philosopher, José Ortega y Gasset, would put it.[Note 9] It states an understanding of the educational situation. It does not adduce arguments that this understanding is either the one true understanding or the only good and upstanding way to see things. It is a probe; it puts forth a proposition for test -- here is the basic understanding of the current juncture, an understanding that many educators share in a form that ranges from the tacit to the explicit, from the inchoate to the mature. This probe can prove correct to the degree that other educators, on reflection, find that they hold a similar understanding of the educational situation.[Note 10] And then the probe can take on some power if it helps educators act with greater awareness of the shared potentialities inherent in their situation as they adopt diverse programs and actions.[Note 11]

18: One might here launch into an extended discourse on intellectual methodology, discussing obtuse topics -- hermeneutics, the *Geisteswissenschaften*, interpretative sociology, and historical pedagogy. Let us leave those topics for different essays.[Note 12] Here we seek, through interpretation, an emergent sense of shared direction and we are doing so by concentrating on two topics. So far, we have been asking what educational options the new technologies significantly empower, and how they do that, and why they have those empowering effects. To the first question posed above -- What

sorts of pedagogical options do educators sense the innovations in digital technology are empowering? -- we are suggesting the emergence of a widespread, shared understanding among educators that the innovations are empowering a significant transformation of the educational system. Engagement with the new technologies engenders among educators a basic understanding that the fundamental problem to be addressed through education, the range of resources useful in addressing it, and the characteristic results of addressing it well are all open to historic transformation. 19: We are ready now to seek, second, a clear agenda of educational work and innovation that these newly empowered options are enabling educators to pursue effectively. The first topic has concerned the ways that educators perceive the limits of practical possibility to change as a result of technological innovation. The second concerns how new ranges of possibility lead educators to form a renewed and altered spectrum of public and professional imperatives for action. In the pages that follow, we offer an interpretative response to these questions. As educators perceive digital technologies to empower new options, what agenda for sustained effort do they think will make these options have results of significant human value?

20: Throughout the course of this discussion, we will be concentrating on a rather sharp, binary opposition between traditional education and the new system under social construction, without extended attention to the particular steps within the middle ground by which circumstances metamorphose from one to the other. Action in the midst of real circumstances always consists in small, concrete repetitions or innovations, not grand departures. How is it then that significant historical change occurs? It is through the cumulative impact of small innovations in the midst of real circumstances, which, when oriented to a transformative possibility, can amount in the aggregate to the grand departure. Without an orienting vision, the likelihood is much higher that actions will consist primarily in the small historical repetitions, with their aggregate amounting merely to an extension of the status quo. Seeking change, we concentrate on the binary opposition, therefore, to free ourselves from the weight of historical inertia, enabling us to develop more and better concrete innovations in specific situations.

21: Revolutions take place simplistically on the level of guiding principles. Continuity asserts itself as people engage the obdurate details of life.[Note 13] The social construction of historical change comes about in a middle ground as many people in many situations develop similar understandings of the potentialities inherent in an historical situation. Acting on that understanding, they independently work in concert towards distant and demanding purposes. In this way, powerful goal-directed actions emerge in history.[Note 14] As new communications technologies take hold in practice, educators sense that new developments become feasible through them. As diverse educators act in diverse ways on the basis of this shared sense of new potential, they begin to change the character of general practice. Can these changes aggregate into an emerging new form of education?

Towards a New Education

22: New information technologies are opening the system to new possibilities as surely as new building technologies did to architecture some hundred years ago. But the technologies do not design new practices for us. People, acting in the face of uncertainty, must determine what they can make of these emerging possibilities. Many groups and interests, pursuing many divergent inspirations, are vying for command, and a kaleidoscope of coalitions establish, through a diversity of initiatives, emerging norms of practice. Do people working in intellectual institutions and knowledge industries -- the world's schools, colleges, universities, research labs, libraries, museums, and professional offices -- share a sustained agenda with which to shape newly emerging educational practices? In the remainder of this essay, we outline a positive response to this question -- again a response that does not aim to persuade others what they should think about the matter, but does instead claim that the response is the way we do think about the matter when we reflect upon it, to suggest in a tentative, factual way that educators do indeed share a powerful agenda.

23: Other groups, aside from the knowledge industries, may play a significant part in determining the course of educational innovation. Many in journalism and commerce avidly attend to the entertainment industries as potential sources of educational innovation. They may be right in viewing practitioners of edutainment; -- the merger of education and entertainment in products, at once enlightening and engaging, to be marketed to both home and school -- as key groups determining emerging pedagogical prospects. Certainly, a great deal of commercial capital currently drives efforts to develop edutainment products, and there are powerful channels of distribution available to reach the public.

24: Significant limitations to these efforts, as efforts to restructure educational practice, are at work, however. The stuff in trade within edutainment is a set of products to be sold in the educational markets of home and school. Indubitably, schools and teachers and students, engaged in the work of education, constitute a market for the sale of various goods -- food, books, clothes, pens and pencils, furniture, fuel oil, rings, electronics, and software. Education, as such, however, is not inherently a market, with success measured in market share and the relative efficiency in making and distributing product. Many a fool has emerged from a richly financed education, and many others have earned hard wisdom through a sparse regimen of study. As a human phenomenon, education is not a market for products, but a process of growth and transformation, one sustained over many years with success measured throughout the vicissitudes of personal and collective experience. Indeed, many companies may do well by doing good. But producers of edutainment have yet to show whether they have either an interest in the human process of education or the capacity to give intentional shape to it as a whole.

25: Can Disney or Apple or Time-Warner take responsibility for the systemic character of educational experience as it occupies the central activities of over 50 million persons nationally for periods of fifteen to twenty years each? Can they extend that responsibility to the billion or so children and youths who globally will acquire their education over the coming decades? Surely the activities of such companies, like those of mass communicators throughout the twentieth century, will have significant effects on the cultural context within which educational work takes place. But the likelihood that the producers of edutainment, as such and single-handedly, will be the prime movers in reshaping the processes of education is slim. They, like everyone else involved, are

engaged in the social construction of an emergent system in which their agenda, as educators, shapes what they do and do not contribute to the construction.

26: Over coming decades, the primer movers in the course of educational innovation are more likely to be the knowledge industries and intellectual institutions, which are already the prime locus of education. Education is the work of educators, not movie producers, broadcasters, or theme-park operators. Educational institutions -- schools, universities, museums, laboratories, libraries -- are the major factors in the social construction of a new educational system. Worldwide they control a huge annual cash flow, derived from individual, governmental, philanthropic, and commercial sources, a cash flow more than sufficient to underwrite far flung innovation. Furthermore, they control and produce intellectual property of extraordinary breadth and depth. The holdings of Hollywood are but a pittance compared to those of the world's universities, laboratories, museums, and libraries and the changes wrought by the digital technologies are making precisely those holdings more accessible, more productive, and more meaningful in the lives of everyone. What might an agenda for innovation, drawing on the interests and strengths of the knowledge industries and intellectual institutions, be like?

27: To draw the main components of this agenda together, let us survey distinctions that often characterize intellectual and educational work. When people talk about the fruits of intellectual work at its higher levels, they generally think of forms of knowledge spread across an intellectual spectrum that runs from universal scholarship -- pure achievements of disinterested reflection -- to the domains of professional practice -- applied principles of organized performance. This distinction -- for shorthand let us call it the distinction between the academic and the professional -- is the fundamental polarity defining types of knowledge within institutions of education. In contemplating it, we should remember Pascal's great maxim -- "We do not display greatness by going to one extreme, but in touching both at once, and filling all the intervening space."[Note 15] Great research universities include departments of sociology and schools of social work, departments of economics and schools of business, departments of political science and schools of public affairs, departments of biology and physiology and schools of medicine. Across every field, education included, people need both pure scholarship and professional learning. An agenda for use in reconstructing the educational system will touch both the academic and the professional and occupy all the intervening space.

28: It is not sufficient, however, in characterizing intellectual work to reflect only on the forms of knowledge. "Art is long, life short, judgment difficult, opportunity transient. To act is easy, to think is hard; to act according to our thought is burdensome."[Note 16] Intellectual work involves action, action of the burdensome sort in which thought guides the effort. If, from the perspective of intellectual institutions, a spectrum running from pure to applied, from academic to professional, characterizes knowledge, then a gradient, one that runs from theory to policy to practice, generally serves to describe intellectual and educational uses to which people put that knowledge. Sometimes theory guides work and activity; other times policy controls it; and often patterns of practice shape action. Properly speaking, these are ideal-types, like the poles of pure academic knowledge and applied professional learning. As ideal-types they are intellectual formulations applied to the stuff of experience, not empirical actualities substantially in it. Both sets of ideal types span the activities of knowledge and education, and we can use them to form a conceptual matrix that is useful in raising to the full level of awareness the powerful and comprehensive agenda embedded in the social construction shaping a new educational system in our time.

	Academic	Professional

Theory	What controlling principle or reflective worldview determines the overall standards and directions of intellectual and educational activity?	How should theories about the organization of knowledge structure the professional practice of education?
Policy	What basic tasks must intellectual and educational policy accomplish if people are to fulfill the educational potential inherent in prevailing historical conditions?	What must educators do to put into effect policies guiding educational practice that will advance the social construction of a new educational system to historic completion?
Practice	What underlying assumptions and principles can best enable people to shape effective patterns of practice under prevailing conditions?	How should educators organize the daily work of educational activity to enable people to fulfill the best possibilities inherent in their conditions?

29: In what follow, we will explore answers to these six questions in the context of our extended present. Something, we claim, along the lines of each answer is what educators understand, by and large, as they entertain each question while engaged with the effort to incorporate the digital technologies into the work of education during our extended present.

Extending the Enlightenment Vision

Academic Theory: What controlling principle or reflective worldview determines the overall standards and directions of intellectual and educational activity?

30 : In an historical perspective, the present juncture is one in which powerful cultural tools are permeating through all sectors of daily life. What basic worldview accords with the sense of things that people form as they engage this process? What overall perspective, from which people see and interpret the world, does it suggest? This question will offend those still preoccupied with the post-modern debunking of the metaphysical pretensions of Western rationalism. We here ask the question, not as metaphysicians, but as historical sociologists. George Santayana, immersed in slightly earlier variations on these themes, recognized the ineluctable condition in his wonderful essay on *Scepticism and Animal Faith*. As humans, unable to escape the burdens of living in history, we must recognize that life offers us simultaneously both the vocation of science, the relentless questioning of all things apparent, and the vocation of politics, the willingness to act purposefully and consequentially, uncertain what the outcome will be. [Note 17] The human enterprise of which we are a part imperfectly embodies diverse principles with respect to which we need to be both aware and committed. In thought, all things must be tentative and relative; but in action they become definitive and final. When ideas conflict in the realm of action, it is the political vocation of the scholar to reflect, weigh, and take a stand on controlling principles. Such situations give rise to the effort of academic theory, and however unfashionable, the conflict of ideas in action is still fundamental to resolving the historical dilemmas of our time. As educators engage the emerging realities, where will they stand?

31) Historically, the contemporary academic enterprise has its roots in enlightenment ideals.[Note 18] As educators engage in work with the new technologies, they will revitalize these ideals -- a commitment to reason, to progress, to universal rights and betterment, to combating superstitions and ignorance. *Écrasez l'infâme!* A major theme

of twentieth-century Western culture has been a sustained and many-sided critique of this commitment, yet the work of the enlightenment is far from finished. The great destabilizing tragedies that potentially loom are rooted in sectarian clashes and collective ignorance. Ideals of universal education are woefully far from fulfillment, and if we measure education as mastery of the knowledge and skills requisite for coping effectively with the complexities of human circumstances, people everywhere may be rapidly receding in their educational attainments.[Note 19]

32: Fashionable critiques of enlightenment aspirations persuade thoughtful observers who start with a largely tacit sense that further and further application of enlightenment principles has been doing more harm than good. Good principles in excess become destructive. Too much schooling, too much bureaucracy, too much material production, too much environmental intervention, too much health care, too much consumption of resources -- it all will exhaust, enchain, and disenchant. Such reasoning may be true as far as it goes, but the critique assumes that the human repertoire of action is essentially fixed and unchanging. The historical impasse is at hand, so the worry goes: those familiar agencies, which we risk exercising too much, are the only possible agencies with which we might advance towards enlightenment ideals. Therefore, we must turn away towards some other fundamental goals or suffer historical shipwreck.

33: Here the point is not to argue against this diagnosis and prescription. It is instead to make an observation. As educators increasingly work with the new technologies in the extended present, they experience a basic counter to the pessimistic view, at once so weary and wary. Current innovations insinuate into daily circumstances grounds for the recognition that the relevant agencies of action are not finite and fixed. The new information technologies provide powerful, under-utilized tools for pursuing the ideals of universal education and the right of all to engage as equals in the common pursuit of life, liberty, and happiness. Engaged with emerging possibilities, people working to apply digital technologies to education experience a sense of historical empowerment and assert articulate views about the value of their effort for the character of the human enterprise, namely that people can and should use these new tools of communication to carry the work of enlightenment forward to unprecedented levels of fulfillment. In the common sense of this experiential world, digital technologies are an expression of the power of reason in human life, making plausible the hope and expectation that reason is still becoming an ever-more effective asset in the service of human life. Educators are far from having made their mission obsolete, and the digital technologies provide an important new means to advance further towards unfinished enlightenment aspirations.

34: In the natural order of things, humans are the beings that enter into the struggle to survive aware individually of their personal mortality. This personal awareness of impending death has deep effects on the struggle for survival. It has two great cultural consequences. First, it makes humans naturally social and political animals, for the individual aware of its mortality can achieve survival only through the future of its collectivity. The person who knows that his or her death impends must either despair or sublimate the sense of self into some enduring grouping. Second, this commitment to a social self entails a cultural and educational commitment to one's progeny. Humans take many years to develop from infancy to maturity and to ensure survival through the collectivity, members of it must nurture the young and impart to them the distinguishing characteristics of the group. The great variations on human culture are complex constructions through which mortal individuals create transcendent selves for the betterment of which we live.

35: There is, in this sense of a collective self binding mortal individuals into an immortal enterprise, a culture of enlightenment, and it might best be called the progressive contract with posterity. It is the most powerful of the cultural constructions that humans have yet devised to deny personal death through the life of the collectivity.[Note 20] In this version, rational individuals that struggle to survive, knowing they will die, naturally develop a progressive commitment to posterity, through which they try to pass to their progeny the possibility of a more secure, productive life than they themselves have enjoyed.[Note 21] This progressive commitment to posterity is the essential principle of enlightenment aspirations, and in espousing these, educators give their work meaning with respect to the basic human condition, helping to construct the collective effort at survival despite the personal mortality each faces. In coming decades people must extend this construct as they cope with tremendous difficulties in an effort to achieve global stability, ecological and geo-political. The educational challenges are stupendous and full historical use of the digital technologies is essential to meet them.

36: Critics who complain that digital tools are not culturally neutral are correct.[Note 22] These tools are expressions of enlightenment reason, the work of abstraction in operation, but should we therefore shrink from them, as these critics imply? The digital tools renew the opportunity to reach out to all persons with the glorious challenge -- "*Sapere aude!* 'Have the courage to use your own reason!*"[Note 23] The world, as it is, is not in equipoise. Educators working with the new technologies command powerful tools, historically significant tools. Educators need to look beyond the myopic topic of computers in education to the question of what they can and should accomplish as educators making full use of digital tools. These are wonderfully powerful tools. Educators should use them to pursue historically challenging goals -- achieving the fulfillment of basic human rights; securing physical well-being in a sustainable global environment for all; eliminating prejudice, poverty, despair, and disease. Progress is neither automatic nor secure. By the same token, it is neither impossible nor illusory. It is a work achieved through intelligent effort, a measure of fulfillment in life. That is the hope and aspiration pursued in working to fulfill the progressive contract with posterity.

37: To read the *Declaration of the Rights of Man and of the Citizen*[Note 24] as preparation for watching the nightly news or reading the daily paper is humbling: human behavior, locally and globally, is far from meeting the measure of such principles. Higher criticism easily deconstructs the language with which thinkers asserted the abstract universals of our political heritage. Thus "the rights of man" is a self-deflating locution for critics modestly alert to gender biases. Nevertheless, its principles, imperfectly phrased, have life and death import depending on whether they do or do not control the formation of intention as persons equipped with powerful instruments of destruction engage in social action in the heat of hate, resentment, and fear. Humans use abstractions both to enable action, to determine controlling intentions, and to adhere to defining restraints. In the social construction of a new educational system, educators need to possess and to impart principles suitable for determining intentions in a world in which the instruments of action are global, complex, and massive in effects. Our world is the posterity of people who pursued demanding visions, initiating a rule of law, industrial production, systematic science, effective medicine, universal schooling. They asserted these possibilities often while living under atrocious conditions, and the measures of dignity, comfort, and well-being that we enjoy derive largely from their efforts. But that well-being is neither stable nor universal. As educators now exploit the pedagogical power of digital tools, we need to be equally bold and deep, extending to our posterity a fundamental advance in the historic potentials of the human enterprise.

38: "Enlightenment," and labels like it, are retrospective characterizations. They come into use because people historically engaged substantial problems and opportunities, accomplishing results of enduring significance. To construct a new educational system, educators need to engage the great problems and opportunities of our extended present with substantial, epochal effort. If educators using digital technologies can be no more effective in addressing the fundamental challenges of time than we could be without those tools, our historic meaning will prove marginal.

- Human productive and reproductive power has suddenly expanded the scale and complexity of action and consumption vastly, raising deep doubts about long-term stabilities for both polities and ecologies. Can the world's peoples educate themselves sufficiently to make this expanded scale and scope of action sustainable?

- Commerce, technology, industry, communication, global transportation have all thrown the world's peoples into highly organized, rationalized, mechanized surroundings, choreographed with intricate, abstract interdependencies in which the moving meanings of life seem challenged, suppressed by civilization, magnifying and multiplying the discontents each feels in accepting its complex constraints. In this iron cage of modernity, can the world's peoples achieve through their education both the measure of meaning and the command of competence with which they can make it a habitat conducive to their full human fulfillment?

- Through the foreseeable future, on the local, national, and global scale, economic inequality and cultural differences will persist, fomenting resentment and fear, misunderstanding and hostility, while even the lone extremist can wield weapons that challenge the stability of societies and states. Can the world's peoples develop educationally the ability to celebrate human differences, allowing everyone around the globe to answer that most difficult question -- "Can't we all just get along?" -- with a sure and effective affirmation?

These are difficult questions and the human worth of technology in education depends substantially on how well it helps educators answer them with historical effect.

From Cultural Scarcity to Profusion

Academic Policy: What basic tasks must intellectual and educational policy accomplish if people are to fulfill the educational potentials inherent in prevailing historical conditions?

39: Throughout educational efforts up until the current historic juncture, the problem of policy has been to deploy and allocate scarce information and educative resources. This condition is shifting in the extended present in which we live. What we see now with the World Wide Web is a hint at the fullness of cultural participation that is becoming the birthright of each and every child. Educational policy as it has existed has been a complicated system for allocating differential access to the cultural assets of the world's civilizations and for legitimating the results. Soon, educational policy will need to be redefined to take into account a completely novel starting point -- all the resources of the world's cultures will in principle be available to any person at any place at any time.

40: Cultural scarcities will surely persist because some people will choose for religious or cultural reasons to forego access, because some political regimes will impose censorship

and limitations, and because some individuals and organizations will have sufficient commercial leverage to price access to some resources beyond the means of many. Such retrogressions notwithstanding, the bulk of cultural resources are becoming available to anyone at any place and any time, and the problem of policy shifts significantly with that new condition. Of course, this new condition is becoming a reality for all people only over an extremely extended present.[Note 25] It is taking, however, a very short time to become an approximate reality for very large numbers of people living in the more developed sectors of the world. As people in advantaged societies start to enjoy random access to unlimited cultural resources, the policy problem shifts from one of allocating scarce resources to managing relatively abundant ones. Let us explore the character and consequences of such a shift.

41: In many different ways, traditional educational policy has served to allocate scarce resources so that preferential access will benefit society and seem legitimate to its members. Policy issues have turned on a fundamental trade-off between people and cultural resources. Under a regime of scarcity, educational institutions can avail a narrow selection of the culture to all people and a full representation of it to a few. In every polity and society throughout the world, formal educational systems consist of pyramidal structures in which very large cohorts receive instruction in basic subjects -- reading, writing, and arithmetic. As cohorts move upwards from that base, their numbers dwindle as the selection of the culture that they receive becomes fuller and more complex and testing, counseling, and the subtleties of suggestion make many stop the academic ascent. At the apex, a very few gain command of comprehensive research and professional collections. The regime of scarcity seems a natural necessity, for those comprehensive collections were both fragile and costly, and universal participation in advanced cultural activities was a practical impossibility. The whole structure of educational opportunity necessarily identified and prepared a limited number who could make optimum use of the exhaustive resources while endowing others, in due measure, with lesser educational opportunities correlated to their aptitude and need.

42: Digitized cultural resources will have very different economies from those of printed cultural resources. With printed texts, the bulk of production costs are absorbed in the costs of physical reproduction, along with the costs in libraries of storage and preservation. The curve of supply and cost for printed information rises steadily, perhaps even accelerating as large collections require special buildings and staffs for their maintenance. The developing curve of supply and cost for digital resources is different. It has a very steep initial threshold, which is becoming lower as the information infrastructure becomes fuller and more efficient. But above that threshold, both the cost of adding more resources to the set of those available and the cost of making the set accessible to more and more people is low. Legitimizing harsh differentials in the degree of access ceases to be a significant policy problem when everyone has nearly unlimited access to the full stock of cultural assets of the world's cultures.

43: One can find diverse examples of the way in which cultural and educational policies turn on determining and justifying exclusions, or what is the same thing, legitimating inclusion of a few out of many. Such a policy emphasis holds within informal education, as well as in formal.

- "All the news that's fit to print" implies not only that the *Times* excludes a lot, but also that this exclusion is legitimate, for everything that is somehow fit makes it into the paper. Clearly under the constraints of print journalism, the *Times* does a reasonable job at being a comprehensive paper of record. Yet contrary to slogan, many readers undoubtedly have criteria of what is fit

for inclusion in a record relevant to their interests different from those of the paper's editors. As the gathering and production of news becomes digitally based, the marginal costs of delivering material gathered, but not printed, will be minimal and the task for a digital *Times* may become one of finding ways by which different readers can project their criteria of interest and importance on all the news the *Times* can gather, so that each reader can find all the news that he or she thinks fit to read.[Note 26]

- Most museums have had limited display space and usually owned collections much larger than what they could exhibit. Curators therefore selected and justified their decisions to show one holding while keeping others crated in the warehouse. With the digital representation of the whole collection, the museum can put all of it on electronic display with the effort of curators serving to help viewers make their own judgments about taste and importance, with the repertoire of works on actual display changing far more frequently, as the "permanent collection" would no longer need to serve its standard setting functions.

Let us abstract from such instance, an ideal-type polarity in which the ambiguities of actuality have been set aside: with constrained media, policy enables authorities to make choices on behalf of users, and with digital media, policy shifts the power of choice to users, and authorities work to facilitate and assist users in the exercise of that power.

44: A movement from the pole of constraint towards its opposite is having profound effects on the formation of curricula. Traditionally, curricular resources in schools represent highly constrained choices and policies determining who teaches what to whom and how measures assessing the resultant performances by students, teachers, and schools all serve to manage and legitimate such constraints. Such policies result in tenaciously ridiculous judgments of cultural worth as educators have had to rationalize a cramped canon and a sample of historical interpretations that have been simplified to the point of stupidity. In field after field the range of cultural resources that have substantial educative worth has far exceeded what publishers could cram into textbooks or schools could purchase for their libraries. Thus the great paradox arose that, except at its most elite pinnacles, education has been a consistently anti-intellectual profession.

45: As digital resources become the basis of the curriculum, the need for these exclusions disappears and the policy problem in education increasingly becomes one of ensuring that all resources are optimally represented in the system and that the navigational tools available to teachers and students dependably enable them to identify and activate the resources that advance their power of cultural participation at the moment when they engage a seminal question. What sorts of policies will conduce to these developments?

- Policies that encourage the full development of the comprehensive digital library.
- Policies that bring high-speed wide-area networks to schools, libraries, and homes.
- Policies that encourage schools to shape their curricula, teachers to design their courses, and students to work together in autonomous groups on substantial projects within those courses.
- Policies that shift issues of curriculum design away from questions of scope and sequence towards ones of problem posing and project initiation.

- Policies that redirect assessment away from measuring how well students know mandated minima to disclosing their ability to manage inquiry and solve problems.

- Policies that situate the locus of learning in small groups interacting with each other in work on genuinely difficult problems.

- Policies that allow schools to redesign the physical spaces of education and to restructure the management of time.

- Policies that make it the responsibility of everyone in education -- students, teachers, administrators, and parents -- to be simultaneously both teacher and learner.

The list might go on, but let it for now suffice.

Towards a Digital Program of Study

Academic Practice: What underlying assumptions and principles can best enable people to shape effective patterns of practice under prevailing conditions?

46: Throughout the era of scarce educative resources, the basic problem of practice has been to make these scarce resources stretch as far as possible. The basic strategy has been the strategy of instruction, which requires large numbers of children to learn in unison. This strategy has been in force for centuries. It is the strategy that accounted for the design of schools, the way classroom practice worked, the organization of the day and year, the plan of the curriculum and the function of textbooks. Under a regime of cultural affluence, the effort to make a few cultural resources stretch as far as possible makes little sense. Other imperatives gain prominence. These are not entirely new imperatives, but their relative importance increases with the change in underlying economics as the information infrastructure shifts from print to digital networks.

47: Inquiry, study, problem solving can become the prime educational activities in a system making full use of digital resources. Educators have often commended these as the best modes of learning, but despite numerous reform efforts, practice always seemed to revert to norms of traditional instruction. The reason is fairly simple -- schools and teachers could not mobilize the diversity of cultural resources required in order to sustain the program of substantive open-ended inquiry that would be generated by many millions of children and youths, with the inquiries of each sustained over a period of ten to twenty years. Under a regime of scarcity, locating the causal agency of education in the power of students to study and inquire would overwhelm available educational resources. Consequently, given the constraints, the causal agency in education has necessarily been located in the teacher. When things go right there is a linear flow of knowledge and skill from the teacher to a class of students with drill, practice, testing, and recitation reinforcing that flow -- it being, alas, all too viscous. Digital resources represent a powerful investment in the power of the student to inquire and to learn. Given effective tools of access, analysis, simulation, and synthesis, students can accomplish many things with these resources that they could not do without them. As a result of empowering students more effectively, what teachers need to do to help students develop knowledge, character, and skill changes as well. These shifts require a difficult change in mind-set about the process of education.

48: By and large the traditional system assumes the worst of students. One of the great ironies is that infants learn to walk and talk largely through their self-directed effort. Thereafter educators become far more paternalistic and generally assume that children

cannot exercise wise judgment about their own education. The cost of this assumption is a frequent estrangement of students from their education. The benefit is a speeding of the process, or so we think, as what might be learned slowly but autonomously by a zigzag path of trial and error is learned instead by the straight and narrow as the student is channeled along pre-designed tasks to the formal curricular objective. Long ago Rousseau argued eloquently throughout *Emile* for a careful cost-benefit trial of this trade-off between educational estrangement and didactic acceleration.[Note 27] There has never been a significant trial at the level of organized practice, largely because the strategy of acceleration has been the only organized practice within which results could be examined. The American progressive education movement tried to minimize educational estrangement by working with students as they set their own pace and direction, but this movement proved fundamentally impracticable under prevailing conditions. As digital resources become the infrastructure for education, it becomes much more feasible to test whether or not paternalistic efforts to accelerate the pace of learning are in fact counter productive and whether both time and value can be gained by ceasing to understand the business of the student as learning what teachers teach and instead recognizing it to be what their name suggests, studying those things that the student finds significant.[Note 28]

49: In constructing a new educational system, centering initiative and control with the student is a fundamental principle of design and a measure of good practice. The role of teachers remains great: it is the role of fomenting questions, doubts, uncertainties; modeling strategies of inquiry; and criticizing the quality of results. In this context, curriculum design becomes the art of posing problems and facilitating work upon them. To so facilitate autonomous work by students requires great skill and sensibility, and teaching may become a more prized and demanding profession. As educators adapt work to empower the student, they will create settings in which

- Students will work primarily in small collaborative groups on challenging projects that take a significant period of time to complete and cut across normal disciplinary boundaries.

- Students will have access to digital representations of nearly unlimited sources and data -- documents, images, recordings, videos, maps, statistics, artifacts, monuments, and so on.

- Students can make effective use of digital tools that enable them to conduct sophisticated analyses, syntheses, and simulations with the result that the work students can perform is much closer in scope and quality to that of advanced scholars.

The transformation of education taking place is not a function of increased access to information. It is a function of increased *participation* in intellectual work -- in advancing knowledge, in applying skill, in exercising judgment.

Reunifying the Educational Professions

Professional Theory: How should theories about the organization of knowledge structure the professional practice of education?

50: In the realm of professional practice, the fundamental theoretical distinction in thinking about educational work is the distinction between K12 and higher education. This distinction is so fundamental that educators rarely reflect on it and the assertion of it as a significant theoretical distinction may strike many as strange. Yet there is a great gulf

between the preparation of professionals for service in K12 schooling and for teaching and research in higher education. Likewise the norms of practice are significantly different, as are the criteria of success and the internal allocation of resources. As professional domains, elementary and secondary go together and higher education, a.k.a., post-secondary education, is something different.[Note 29]

51: This distinction is a good example of how the material conditions of work can shape the way people think about complicated relationships. Expensive libraries and laboratories are a necessity of work in higher education, and their expense is prohibitive in elementary and secondary schooling. Conditions have perforce differed in the two realms and ideas about education have reflected these different conditions. Digital technologies, however, are rapidly enabling us to avoid these fundamental constraints. The knowledge resources created to support advanced scholarship and professional practice are becoming ubiquitous. Where a digital infrastructure exists for supporting intellectual work, the marginal costs of using those resources do not increase greatly as more and more people make use of them. Consequently, the infrastructure of higher education is becoming available in schools as both levels develop their digital capacities. In a major historical departure, the material conditions separating elementary and secondary education from higher education are disappearing. This change is already emerging in schools that have robust connections to the Internet. With this change, the basic pedagogical problem is to develop ways of making these new resources pedagogically meaningful in the education of children. Certainly differences between the K12 and higher education will remain, but educators should rethink what those differences may be in very fundamental ways.

52: Historically, the separation between K12 and higher education has not always predominated. In medieval practice, secondary education assimilated much more to higher education than it did to elementary. Well into the nineteenth century, secondary schools usually linked tightly to colleges and universities, and in Europe to this day admission into the lycée or Gymnasium is the main cutoff, with all graduates of those schools virtually guaranteed general access to the university system. In many educational systems, especially those where the university derives from the medieval guilds of students, faculty members in secondary education substantially have the status and qualifications of their peers elsewhere in the university. Usage of the terms "pupil" and "student" still reflects this linkage between secondary and higher education, as "eleventh-grade pupils" would be condescending and "third-grade students" a bit pretentious. Let us infer from these residual characteristics that present theoretical constructs are not timeless and that renewed, expanded connections between higher education and K12 are well within the realm of historical possibility.

53: Several factors make it plausible that an alteration in the controlling theoretical conception about the knowledge professions is reinvigorating these latent connections between schools and the university. Over the past two hundred years or so, the apparatus of science and scholarship has become more and more elaborate and costly, restricting practical mastery to elites and forcing increasing specialization upon their members. Digital information technologies do not necessarily lower the cost of the apparatus, but they change the economics of participation significantly, making the marginal cost of broader participation minimal. To be sure, it is moot whether, given digital access to the tools and data necessary in creating knowledge and in forming professional skill, a larger proportion of people will be able make good use of it or be interested in doing so, but at least this possibility becomes a question! At least in principle, people at all levels of the

educational enterprise will share and participate together in one full and complex working environment through the digital infrastructure.

54: This material condition makes the unification of the system in a theoretic whole feasible. Several other long-term secular developments increase incentives for scientists and scholars to try to engage a wider public in their work. Weapons related science and technology tended to concentrate effort on the attainment, no matter what the costs, of narrow ends in view -- bigger bombs, faster planes, more discriminating radar, and on and on. Public understanding was only tangentially important in the work of national defense. With the end of the Cold War, scientific priorities have been changing in interesting ways. The general technological efficiency of a population becomes highly consequential under conditions in which material well-being is largely a function of success in global economic competitions. Effective education in technology and science is as important as good research in promoting such technological efficiency. Likewise, as national defense diminishes in priority, public health and a sustainable environment increase in importance as science-related issues. Although both have a critical research dimension to them, they also have very difficult educational problems embedded in them, for in both areas preventative strategies as a key means may prove far more cost-effective than corrective strategies using heroic interventions in the face of crisis. As a result, high-level scientists and scholars are much more responsive to educational issues and scientific funds are supporting broader educational incentives.

55: As universities become more sensitive to their educational missions, a theoretical construct can take hold in which scientists and scholars understand the fundamental purpose being served in the creation of knowledge to be the advancement of education at all its levels.[Note 30] With respect to the educational profession, this comprehensive commitment to education is not resulting in university faculties enlisting in the traditional work of schools of education, preparing teachers and administrators, but rather in generating a wider interest in curriculum, reshaping the whole body of knowledge for broader and easier access, and in pedagogical strategies in which the processes of study and learning throughout education draw people into the work of producing knowledge from early in their educational experience onward.[Note 31] An initial instance of these developments are the tremendous academic energies surging into web site development, with many projects evident that go way beyond the facilitation of research in the narrow sense to the promotion of broad participation in intellectual work.[Note 32] Advancing knowledge becomes a defining good and necessary goal of the human polity and participation in that enterprise becomes both a feasible endeavor and a basic human right for all its citizens.

56: A pedagogy that draws people into the work of advancing knowledge would be a highly empowering pedagogy and one that indicates how the roles of teachers may adapt to the new information conditions. A curriculum supporting this pedagogy facilitates three main functions: posing problems, providing data, and furnishing tools. The pedagogy itself involves various mentoring activities, helping to make sure that students really grasp the problems and questions, that they comprehend key characteristics of the data that they seek, and that they can use the tools of analysis, simulation, and synthesis purposefully. This is the pedagogy of research and in a sense the changes envisioned here suggest that the whole educational system will increasingly be apprenticed to the research apparatus.[Note 33] One can imagine an interesting, emerging new structure to teaching, with general teachers in the school classroom managing inquiry and a network of consultants with special competencies accessible via desktop video conference --

undergraduates, graduate students and professors who help field questions that neither students nor teacher in a class can answer through their independent inquiries.[Note 34]

Questions:

- What needs to be done to advanced knowledge resources to make them interesting and productive to children and novices?
- Should commonsense expectations about what children can accomplish change as advanced intellectual tools and resources become available to everyone?
- Will new ways of identifying and evaluating contributions to knowledge need to be developed?
- Will all this cause childhood to loose its charm of "innocence," or may in unexpectedly infuse adulthood with new currents of "childish" wonder?

Reconstructing the Educational System

Professional Policy: How can educators put into effect policies guiding educational practice that will advance the social construction of a new educational system?

57: Digital libraries, multimedia educational scenarios, and wide-area networking, three related and maturing technologies, have the promise to make advanced media serve as powerful engines of equity. Each of these technologies is of great educational significance. The libraries of the very richest schools currently represent minor academic resources compared to the aggregate resources of the digital library that becomes accessible at the desktop in any school, or home, with appropriate connections to the national information infrastructure. Educational experiences, activated by engaging multimedia scenarios and projects, can appeal to diverse learning styles and engross students of all backgrounds in cooperative, inquiry-based educational work. Wide-area networking can enable desktop video conferencing and group work in a responsive, content-rich context, and these new forms of educative communication can overcome the traditional isolation of the classroom, bringing youthful minds actively into the laboratory, the archive, the field station, the theater, and the office.

58: These technologies, deployed without reserve, do not result simply in increased information access. They result in a substantial transformation in the conditions limiting full participation in cultural and intellectual work. An educational system engaging all in real participation -- in constructing knowledge, developing skills, crafting designs, creating works, formulating theories, testing hypotheses, employing interpretation, exercising judgment -- can enable all students to attain an unprecedented improvement in educational quality. In pursuit of these possibilities, educators need to move from isolated pilot projects, which merely suggest the power of these technologies, to implementing a large, decisive demonstration of it. An unequivocal, undeniable example of what educators can accomplish with the new technologies is the policy key to the social construction of a new educational system.[Note 35]

59: Evaluations of pilot projects do not change controlling public expectations. The cost-benefit equation to be achieved with the thorough use of advanced media in education can prove to be extremely advantageous for the whole society, but, at the same time, it is a very difficult equation to demonstrate in the arena of public discourse. The reason is simple: the benefits of advanced media in education will be very, very great relative to the current state of schooling, yet those benefits can be realized only by raising expenditures on education by a significant increment. How can educators convince a

public and its leadership, one largely bent on cutting expenditures above all else, that increased costs will be worth greatly increased benefits? Evaluation studies of this or that pilot, showing incremental gains of this or that level in this or that grade, do not suffice to make the needed point in policy debate. A sustained, dramatic, large-scale, decisive demonstration, concentrated in a prominent locality that represents the chronic recalcitrant difficulties of contemporary life, will be necessary.

60: Educators need to bring the full resources of digital libraries, multimedia curriculum design, and wide-area networking to bear in all the classrooms of a well-defined area where all agree that education is working poorly. The social construction of a new system ultimately involves mobilization of great historical energy. Such effort does not arise by relying solely on incremental adjustments to established procedures in stable institutions. Hope, expectation, and a sense of efficacy need to mount. Activity needs to build to an uncertain turning point and then resolve because proponent and foe alike somewhere see results evident in the daily news that provide clear proof that a new system works along a spectrum of possibilities far more preferable than the old. Educators need to identify a large challenge with a well-defined, substantial population, a challenge that people hold insoluble, and they need to address that challenge fully, stinting neither effort nor expense, not in one school or a few, but in all the schools in the area of work, in a sustained, dramatic disclosure of new possibilities. That challenge lies with the education of impoverished children in American inner cities.

Digital Learning Communities

Professional Practice: How should educators organize the daily work of educational activity to enable people to fulfill the best possibilities inherent in their conditions?

61: One of the powerful predictors of how children will fare in school is the educational attainments of their parents. This predictor holds across cultures, languages, races, ethnicities. It poses a difficult challenge. In populations where the educational attainments of parents are low, how can their children achieve educational excellence? To answer this question, we need to ask another. Why is parental educational attainment such a powerful predictor? The reason is not obscure. Parents with significant educational attainments have better insight into the processes of formal learning and the strategies for success at it, and they are more likely to surround their children with intellectual resources that will prove supportive. In a myriad of subtle ways they pass their experience to their children. Parents who have not been successful in this formal schooling may pass on other kinds of knowledge that largely go unrecognized by the school culture. The challenge before us is to find a way to bring these ways of knowing together and to empower parental influence for all children in the processes of schooling.[Note 36]

62: Use of networked technologies, combined with a strong community of people learning together, will alter this cycle of failure that our educational structure, inadvertently perhaps, have helped to arrange. Throughout the twentieth century, educational and social services have been highly segmented and specialized. Elementary schools serve children, aged 5 to 12, dividing them all up according to annual age cohorts. So too with the numerous other segments of the learning society -- high school, adult education, job training, college, counseling, and so on. Schooling and other community services all occur in separate spaces because the information resources and specialists necessary for each function required a distinctive location and deployment. The information technologies of the twenty-first century change these conditions, and

make the resources needed to sustain numerous different educational functions ubiquitous.

63: We hypothesize that this ubiquity of diverse educational resources will permit educators to break the cycle of reproduction in educational attainments. Parental empathy with the learning processes of their children will be greatest if the parents are fully engaged in learning themselves. So, too, with teachers and the surrounding community. We think that school should increasingly take on the characteristics of a *learning community*; comprising children, their parents, and professionals, all of whom are engaged in serious efforts to extend their education further and to participate in the common intellectual enterprise. To prototype such a learning community and to show its potential power in breaking the cycle by which patterns of educational attainment reproduce themselves from generation to generation, imagine a digital learning community in which all members -- students, teachers , administrators, and parents -- should continuously work in collaboration with each other to pose difficult questions and to work on answering them with the full intellectual apparatus of the culture. Through networked technologies and continuing involvement with other learning communities, universities, and public interest groups, each should have access to the resources and assistance to make headway on such goals.

64: Advanced information technologies make construction of integrated learning communities far more feasible. The ideal of parents and children, teachers and community members joining together in the shared nurturing of their human potentials is not new. It has been a difficult ideal to actualize, for the resources that will help the child differ from those that will help the parent, or the specialist, or community member. Networked technologies make it possible, through a single location, to engage a diversity of people with challenging learning scenarios, providing each with appropriate resources and useful intellectual tools.

65: Let us put aside the traditional image of the educational ladder, with children clambering, rung by rung, up the sequence of grades, some falling off as drop outs, some scaling the whole way to college graduation, walking thereafter the plateau of middle-class affluence. Let us image instead a learning community, with its youngest children entering at its very center and then moving outward as they grow through a series of concentric circles, with parents, teachers, and other adults ringed around them, with lines of interactive electronic communication linking all, from the center of these circles out, to the full range of cultural institutions and specialized resources of the society.

Conclusion

66: If the agenda, sketched in the pages above, approximates the historic task of social construction required in building a new educational system enabled by digital technologies, then we see that we are at most at the beginning of this effort that spans our extended present. The technological part is the easy part. The work of educational innovation stretches before us with demanding challenges.

- Renew the progressive contract with posterity by using new tools to pursue historically challenging goals -- achieving the fulfillment of basic human rights; securing physical well-being in a sustainable global environment for all; eliminating prejudice, poverty, despair, and disease.

- Shift the central concern in cultural and education policy from limited access to open participation, displacing the long-standing politics of exclusion with a vibrant, many-sided politics of inclusion.

- Affirm the importance of independent inquiry and study as the engine of education, de-emphasizing the traditional dominance of instruction.

- Redesign the relation between K12 education and higher education with an integrated intellectual environment active at all levels, engaging all as creative participants in the cultural enterprise.

- Develop a demonstration that new educational possibilities can address the intractable problems of the old system on a scale sufficient to change public expectations.

- Create digital learning communities as the new milieu of practice where people meet face-to-face and via video conference, with people of mixed ages and interests engaged together in the effort of learning, supported by each other, by complete digital libraries, by open wide-area networks, and by powerful tools of analysis, synthesis, and simulation.

When such tasks are complete, then the work of social construction will have run its course. Much is to be done.

Notes

Author's Note: This text is version 1.0 of this essay, the master version of which is located at `http://www.ilt.columbia.edu/mcclintock/renew/index.htm`. It will be under continuous development as part of the Institute for Learning Technologies' Digital Text Project. (`http://www.ilt.columbia.edu/academic/digitexts/index.html`). The master version is formatted to facilitate reflective reading on-line and requires Netscape 2.0 or higher and a display of 1024x768 pixels or better to view properly. One of the assumptions informing this project is that for the foreseeable future authors will be unable to predict whether readers are using on-line or hard copy versions of their work, with the consequence that page references are obsolete and a device-independent form of citation is a serious intellectual need. This essay uses numbered paragraphs as the means of referencing locations within the text and anyone who wishes to cite passages within it should use those, which will work regardless of what device, format, or font a reader is using.

1) *The Portable Nietzsche* (New York: Penguin, 1968), Kaufmann, trans., p. 50.

2) Large-scale digital library projects can seem to be concerns primarily for rarefied scholarship. In fact they are developments of broad public import and care should be taken to widen the constituency for the effort. For a sense of the global participation in developing through the digital library effort consult, for instance, Columbia University's guide to electronic texts on the Internet (`http://www.cc.columbia.edu/cu/libraries/indiv/ets/offsite.html`). A good discussion of issues, current to 1993 and oriented to the Bibliothèque de France, is in R. Howard Bloch and Carla Hesse, eds., *Future Libraries* (Berkeley: University of California Press, 1995). To grasp fully both the difficulties and the possibilities of digital libraries, readers need sustained engagement with the resources on-line, however. There is a huge, distributed effort taking place world-wide as libraries and archives metamorphose, the dynamics of which it is much easier to experience than to describe.

3) For reflections on multimedia in a philosophical frame see Mark C. Taylor and Esa Saarinen, *Imagologies: Media Philosophy* (New York: Routledge, 1994). In regard to bringing new media into the realm of random access, it is interesting to follow the range of plug-in programs developing for a web browser such as Netscape.

4) Skeptics who intone that changes in the access to information do not necessarily lead to a better education, and may worsen it by furnishing people with a surfeit of trivia, miss the significant change. The new technologies do not simply enhance information access.

They change conditions for participating in the creation of knowledge, the exercise of skill, the work of interpretation. It is not information access but cultural participation that is widening significantly, for better or for worse. This development clearly poses difficulties, but it is a development that is deeply protean in historical character and potentiality. This development is also clearly not new, for participation in cultural activities has already widened discernibly throughout the nineteenth and twentieth centuries with the opening of access to institutions of education. Thus Thomas Hardy's *Jude the Obscure* depicts social barriers internalized in institutions, situations, and persons that have become much less rigorous as prevailing norms of experience by the late twentieth century than they were in the late nineteenth. The historical limits to a widening of participation in intellectual activities have by no means been reached. Loosely but suggestively, entertain the following analogy – twentieth-century changes in cultural participation are like the nineteenth-century changes in travel occasioned by railroads, whereas twenty-first century changes in intellectual participation are like the twentieth-century changes in travel associated with the automobile and aviation.

5) Key sources on the history of the telephone as a social construction are Ithiel de Sola Pool, ed., *The Social Impact of the Telephone* (Cambridge: The MIT Press, 1981); Ithiel de Sola Pool, *Forecasting the Telephone: A Retrospective Technology Assessment of the Telephone* (Norwood, NJ: ABLEX, 1983); and Claude S. Fischer, *America Calling: A Social History of the Telephone to 1940* (Berkeley: University of California Press, 1992).

6) For a good introduction, see *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, edited by Wiebe E. Bijker, Thomas P. Hughes, and Trevor Pinch (Cambridge: The MIT Press, 1987). The concept of social construction used in this essay is somewhat broader than the concept used in the history of technology. Steven Lubar's "Representation and Power" in *Technology and Culture*, 36:2, Supplement (April 1995), pp. S54-S81, is an excellent survey of the relevant historiography. It encompasses the many sides of the problem of making thought actual in the realm of lived life.

7) The work of Max Weber is fundamental to thinking about the social construction of significant historical developments. Paraphrasing Weber's definition of social action, we can say here that the social construction of technologies result because people attach similar subjective meanings to the potentialities they sense in their circumstances and they consequently act independently in ways that conduce to common purposes. See *Economy and Society*, I:1:a&b, and passim.

8) Nicomachean Ethics, I:2; 1094b24, Ross & Urmson, trans. (On-line: W.D. Ross, trans.)

9) "Pidiendo un Goethe desde dentro" (1932), José Ortega y Gasset, *Obras completas*, IV, Madrid: Revista de Occidente, 1957. pp. 395-420. The methodological lineage here goes back through Ortega, via Wilhelm Dilthey and Friedrich Schleiermacher, to Giambattista Vico. The basic problem is that integral to the human sciences - attaining knowledge where a separation of knower from known cannot plausibly be made.

10) It is important to test this probe fully in the Socratic spirit. Querying educators and finding the proportion that would nominally agree with the propositions of this probe would tell little, one way or another. Whether or not each person, on serious and sincere reflection, considers it sound is the Socratic test.

11) Theorists have long struggled to make sense of the process by which complex historical developments emerge in history. Rousseau's observations in the *Social Contract* about how people should deliberate in order to disclose the General Will are highly relevant in considering this process, particularly if one discounts the locus in a

cantonal assembly that he used to situate his discussion. See Rousseau, *The Social Contract*, II:3. Likewise, Reformation doctrines of Grace and Election, understood as a theological construct for describing observable historical developments, merit some reflective attention in thinking about pre-Weberian reflections on the dynamics of social construction.

12) Note on *Hermeneutics and Education* by Shaun Gallagher (Albany: The State University of New York Press, 1992) is a useful introduction to the educational import of these traditions. Much remains to be done, however, to employ them fully in the understanding of educational possibility and practice.

13) *The Structure of Scientific Revolutions* by Thomas S. Kuhn (2nd edition, Chicago: The University of Chicago Press, 1970) provides an excellent study of these dynamics in the area of scientific practice, as did Alexis de Tocqueville for political practice in *The Old Régime and the French Revolution*.

14) A phrase here merits some elucidation -- "potentialities inherent in the present situation." It is hard to make sense of such potentialities, and also the social construction of complex developments, through causal explanations. When one plants a seed, or feels impressed by a child's future possibilities, or responds with excitement to an unexpected professional opportunity, one is dealing with "potentialities inherent in the present situation." In dealing with the fullness of life, we do not only think about things linked in a linear succession in time, with A causing B and B causing C and so on. We also think about things as they coexist through an extension of time and space with lots of different things all reciprocally interacting, sensing that later states are implicit in former ones, should all the ensuing interactions play out in certain ways. Immanuel Kant used this distinction to distinguish fundamental analogies drawn from experience - the principle of succession of time, according to the law of causality, and the principle of coexistence, according to the law of reciprocity (Critique of Pure Reason, b232-b264). This distinction is important throughout this essay.

15) Pascal, *Pensées*, 353, Trotter, trans. English translation on-line in one big Gopher file.

16) Goethe, *Wilhelm Meister's Apprenticeship*, Book VII, Indenture, Carlyle, trans. (revised).

17) George Santayana, *Scepticism and Animal Faith: Introduction to a System of Philosophy* (1923, New York: Dover Publications, Inc., 1955). Translations of Max Weber's speeches on "Politics as a Vocation" and "Science as a Vocation" are in *From Max Weber: Essays in Sociology* edited by H. H. Gerth and C. Wright Mills (New York: Oxford University Press, 1946).

18) Let us use the term "enlightenment" in a very broad sense to direct attention to developments rooted in Renaissance and Reformation, passing through the European Enlightenment of the seventeenth and eighteenth centuries, and sweeping through the age of democratic revolutions, imperialism, and the global warring, hot and cold of the twentieth century. In this sense, the enlightenment involves the historical construction of modernity, in particular the construction of secular cultures, scientific and technical reason, industrial economies, nation-states, democratic polities, bureaucratic management, systems of public health and education, massive cities, and global transportation and communications.

19) Henry Adams, in *The Education of Henry Adams* gives an extended meditation on the historical relativity of educational attainments and the terrible cost of remediating their debasement. "The picture of Washington in March, 1861, offered education, but not the

kind of education that led to good. The process that Matthew Arnold described as wandering between two worlds, one dead, the other powerless to be born, helps nothing. Washington was a dismal school. . . . Not a man there knew what his task was to be, or was fitted for it; everyone without exception, northern or southern, was to learn his business at the cost of the public. Lincoln, Seward, Sumner and the rest, could give no help to the young man seeking education; they knew less than he; within six weeks they were all to be taught their duties by the uprising of such as he, and their education was to cost a million lives and ten thousand million dollars, more or less, north and south, before the country could recover its balance and movement." Henry Adams, *Novels, Mont Saint Michel, The Education* (New York: The Library of America, 1983), pp. 818-9. As the scale of human action increases, with irreversible global effects unfolding over decades and centuries, the human costs of historical remediation can now far exceed those on which Adams reflected.

20) Religious cultures might seem far more powerful, measuring the matter by numbers of professed adherents, even in this supposedly secular age. Nominal adherence is not a good measure of historic power, however, as a glance at the historical demographics of the human enterprise will indicate.

21) Kant's stricture in "What Is Enlightenment?" -- "For himself (and only for a short time) a man may postpone enlightenment in what he ought to know, but to renounce it for himself and even more to renounce it for posterity is to injure and trample on the rights of mankind." -- states succinctly this bond between the dignity of the rational individual and the rights of posterity. Beck, trans., *Berlinische Monatsschrift*. Dezember-Heft 1784, p. 490, equivalent to *Königliche Preussische Akademie*, 7:39.

22) A typical instance of this complaint is C. A. Bowers, *The Cultural Dimensions of Educational Computing: Understanding the Non-Neutrality of Technology* (New York: Teachers College Press, 1988).

23) Kant, "What Is Enlightenment?", *Berlinische Monatsschrift*. Dezember-Heft 1784, p. 481, equivalent to 7:35.

24) The document is in many collections, on-line in English and in French.

25) As early as 1630 in his *Great Didactic*, Johann Amos Comenius described systems of universal compulsory schooling that he perceived to be potentials implicit in the design of good textbooks and of schools pedagogically adapted to working with them. It took close to three centuries to implement those potentialities in the extended present of print-based educational reform.

26) A major value-added that would continue to differentiate different new organizations would be in the accuracy and competence with which the news was gathered and its accuracy guaranteed.

27) See the discussion of "gaining time by loosing time" in *Emile* (Bloom, trans.) *passim*.

28) Constraints in the information infrastructure are, of course, not the only factors leading people to design an educational system around efforts to channel and accelerate the pace of student learning. The argument here, however, is that educational alternatives to such arrangements, although frequently suggested, have never been significantly implemented because the constraints in the information infrastructure have rendered such alternatives impracticable. As those constraints change, the historical verdict potentially changes. Let us put it this way: If, broadly speaking, the introduction of printing in Europe empowered failed medieval heresies to become the dominant theology in major areas of western Christendom and to force deep reform throughout the remainder, so too may the introduction of digital technologies in post-industrial societies empower the

failed educational heresies propounding child-centered schools and progressive education to become the dominant educational system in the twenty-first century.

29) In schools of education, which have one foot in the realm of K12 education and the other in higher education, one of the most interesting cleavages is between those faculty members who adopt as norms of their teaching and advising the norms of higher education and those who adopt the norms of K12 schooling.

30) Such a purpose, making the broad education of the public integral to the imperative of advancing knowledge through research, is fully consistent with the original purposes set forth by pioneers of the modern intellectual enterprise in works such as *The Advancement of Learning* by Francis Bacon, which aimed to persuade the sovereign of "the merit and true glory in the augmentation and propagation of" learning and knowledge (I, "To the King," 3).

31) There is some danger that digitally enabled innovation in education will bypass schools of education, which are somewhat separated from developments in major research universities (even when functioning as a school within such universities). Much initial pump priming for a changed university role in education has been done by the National Science Foundation's funding of curricular initiatives at all levels, and by and large this funding has gone to state and local school systems or to university projects with roots in research science. It is important that faculty members in schools of education leave their familiar turf and involve themselves in university-wide projects as participants in much more complex development projects.

32) One barrier to these developments lies in the inertia of promotion and tenure procedures, which may channel effort by many junior academics away from working with new media. Perhaps universities should start refereeing contributions to their web sites, not simply to guarantee the quality of research contributions, but also (perhaps primarily) as contributions to the educational effectiveness of the site.

33) In programs such as *Archaeotype*, developed through the Dalton Technology Project, this pedagogical model seems to work very well as early as the middle grades. See *Evaluation of the Dalton Technology Project from a Thinking Skills Perspective* by John Black, Clifford Hill and Janet Schiff (New York: CCT, Teachers College, Columbia University, 1993). On-line description.

34) Such services to problem-solving groups in schools may be the response that enables the university to avoid the educational obsolescence anticipated by Eli M. Noam in "Electronics and the Dim Future of the University," *Science* 270:13 October 1995:247-249. Noam suggests that publishers and media companies will take over the traditional forms of university instruction and academia will find itself without a teaching function. Noam does not take very concrete account of the ways in which familiar instructional forms can metamorphose to take account of new informational conditions. Canned lectures by the putative great teachers of the world may have far less educative value than timely consultation via video conference with someone over a question of common interest. It is a commonplace in academe that one does not really learn a subject until one has to teach it and a very productive undertaking for undergraduates and graduate students may involve serving as sources of expertise over networks to children and teachers.

35) It is difficult to convey the idea that fundamental potentialities are now different than they have been in the past. Nevertheless it is important to reason out the possibility so that things can be tried that would otherwise be held impossible. Here is a working drawing from 1884 from an early proposal for the Eiffel Tower, in which the engineers are trying to convey the idea that structures build to an unprecedented scale can be

developed. Unfortunately educators cannot make such a point as succinctly as structural engineers could.
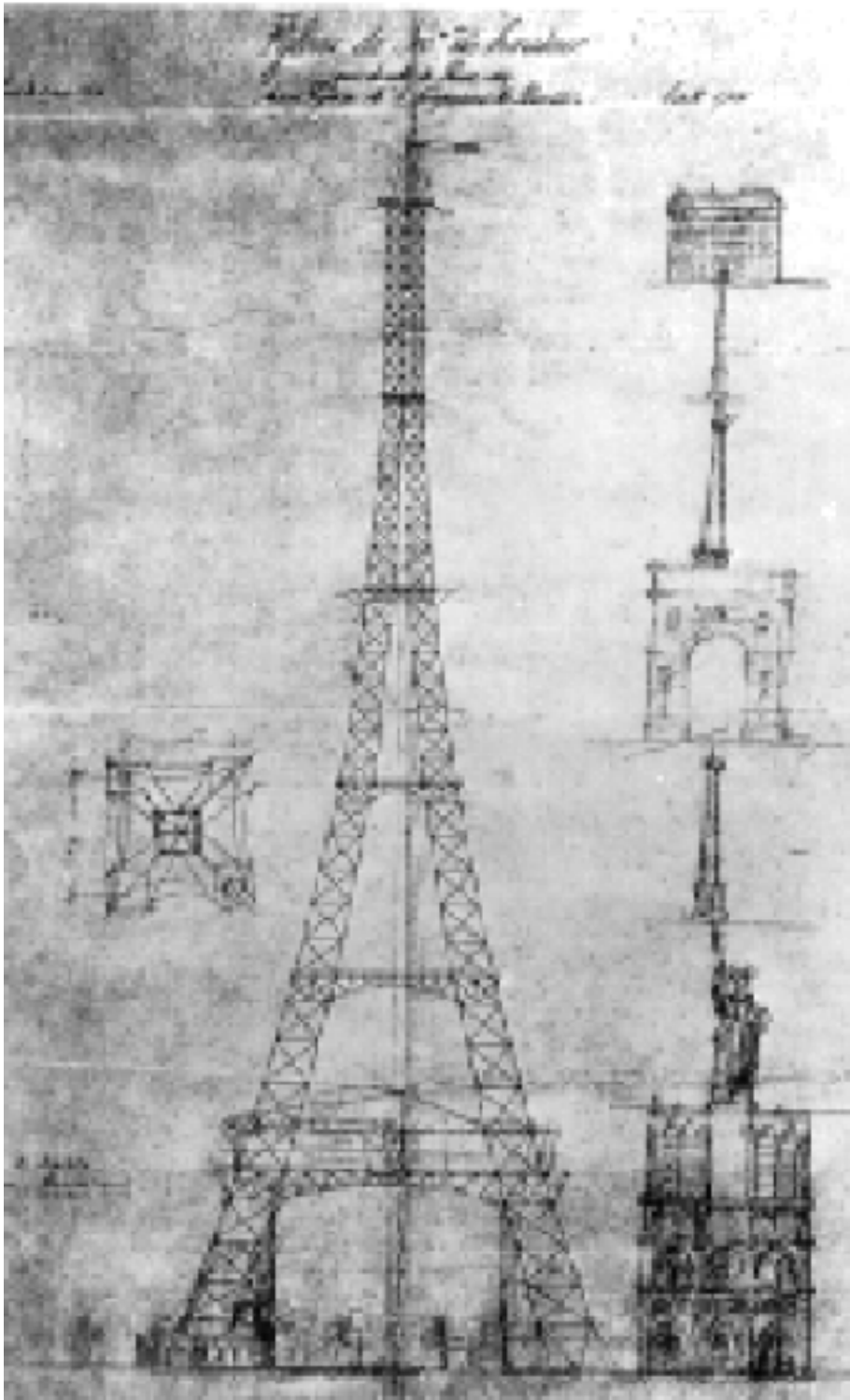
Reproduced from Spiro Kostof, *The City Shaped: Urban Patterns and Meanings Through History* (Boston: Little, Brown and Company, 1991) p. 320.

36) The key source here is *Reproduction in Education, Society and Culture* by Pierre Bourdieu and Jean-Claude Passeron (2nd. Edition, Newbury Park, CA: Sage Publications, 1990), Nice, trans..