The Carlyle manifesto

TSILB*

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Proposal

In 1840, Thomas Carlyle wrote, 'The true university of these days is a collection of books'. In the century and a half since Carlyle wrote, technology has not stood still. Today, the true university is a collection of on-line materials. In this manifesto, I propose that we dedicate ourselves to establishing a collection of on-line materials that will allow any bright and curious person anywhere in the world to explore freely diverse fields of knowledge. I propose to call this the Carlyle Collection.

The university began in medieval times when books were not readily available, and having one person give 'lectures' (literally, 'readings') to a roomful of listeners made good sense. By 1840, improvements in the technology of producing and distributing books had rendered the medieval university largely irrelevant, as Carlyle observed. Now, a century and a half later, printed books themselves have become largely irrelevant, and any lingering need for 'live' lectures has likewise disappeared, thanks to the ability to distribute text and video instantly and universally via the internet.

The on-line materials in the Carlyle Collection will consist primarily of recorded lectures, and accompanying text. Of course many superficially more exciting on-line materials are possible, notably 'interactive media'. These are no doubt useful, but the benefit-to-cost ratio in producing these sexy

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materials is quite low. By concentrating on lectures and text, we can assemble a collection of materials that can very cheaply and effectively provide much of the educational opportunities that universities have to offer. And in contrast to groovy interactive media, it will be easy to ensure that these more static materials have permanent value.

The same considerations lead us to concentrate primarily on recorded lectures, at the expense of the accompanying text. There are plenty of books available, though sadly most are encumbered by copyright. Bright and curious persons everywhere have much better access to text than to recorded lectures. And lectures are cheaper and easier to produce than books. So we will concentrate on lectures.

By providing recorded lectures, the Carlyle Collection can greatly improve productivity at universities by allowing them to teach better with less wasted effort. It will also make educational opportunities much more broadly available, which I confess is one of my primary motivations.

Of course universities offer more than lectures, even at the undergraduate level, to which we will confine ourselves here. Apart from the social and recreational aspects of the university, there are laboratories, seminars, discussions, office hours, and classes where essential interaction takes place. However, the role of the medieval-style lecture is still prominent, even at institutions that pride themselves on their devotion to education at the expense of research. That's why the Carlyle Collection will be so valuable to university education.

Concerning what constitutes a 'lecture', note that the mere fact that it may be possible to ask questions during a lecture does not mean that that lecture can be said to involve essential interaction. In large classes, most students do not have a meaningful opportunity to interact with the lecturer. And even in small classes, students may choose to keep still, either because they do not wish to expose their ignorance, or because they do not want to disrupt the flow of the lecture, or because asking a question opens them up to the need to nod along with explanations which they may have no reasonable hope of understanding without additional time for reflection. We may class as a lecture any presentation that would be more effective if it were not 'live'. (In this connection, see my diatribe 'Dead lectures'.)

So much for the kinds of materials we wish to provide. Let me now say something more about the rest of the proposal, which you will recall is to establish a collection of on-line materials that will allow any bright

and curious person anywhere in the world to explore freely diverse fields of knowledge. This sounds ambitious, and it is time for some judicious backpedaling.

To begin with, we will take 'the world' to mean 'the on-line world', and more specifically, 'the English-speaking on-line world'—admittedly not a trivial restriction! Obviously there is much to be said for efforts to get more people on-line, or to make on-line materials available in a variety of languages, but those problems we will leave up to others.

Then there's the question of what we mean by 'diverse fields of knowledge'. We hope that eventually the collection will eventually come to span a great variety of subjects. Later on, we will describe a pilot project to put together a collection dedicated to certain branches of mathematics. We hope that this pilot collection will serve as a useful demonstration of the possibilities inherent in a collection like this, and inspire others to help push the collection into other fields.

Now, what do we mean when we say that we want people to be able to 'explore freely' these diverse fields of knowledge? Freedom here could mean that people will not held back by limitations in their previous knowledge, and indeed we aim to make the materials as comprehensive and self-contained as possible. Alternatively, freedom could mean that diligent pursuit of the materials in the collection will not take you beyond the bounds of what is known. Here we cannot possibly hope to succeed, though we do aim to address topics that range far beyond those commonly taken up in undergraduate courses.

But what we primarily mean by freedom here is that no one will have to pay for access to these materials: They should be available to any bright and curious person. Just as important, anyone will be free to modify the materials in any way that they think will improve their usefulness, and to distribute the improved materials in whatever way they want, without having to ask anyone's permission. When materials are restricted by copyright, there is a huge barrier to making small but useful incremental changes, or to assembling materials from different sources into a new useful compilation. The result is a stunning inefficiency in the way educational materials are produced, and an ocean of missed opportunities. We want the Carlyle Collection to be able to grow and grow in usefulness. To this end, we will strive as far as possible to make sure that the materials in the Carlyle Collection are free, either because they are in the public domain, or because they are made available under something like Richard Stallman's 'copyleft' scheme, whereby

copyrighted materials are freely licensed to everyone with the provise that all derivative works must be licensed on the same terms.

The materials in the Carlyle Collection will be addressed to the needs of any 'bright and curious person'. They are not specifically intended for use in a formal course. We do expect that these materials will prove useful as a primary resource for people teaching courses, particularly at the college level, and at the advanced high school level. Furthermore, we expect that many of the materials in the collection will come from courses, in the form of handouts, videos of lectures, problems and activities, and so on. However, we want to make sure that these materials will be useful far beyond the confines of traditional courses. While courses, and specifically college courses, are a key part of our notion of how to develop these materials, we wish these materials to be held to a standard that is different from that to which you would hold a textbook, or any other set of materials for a course.

This alternative standard we propose for assessing the materials in the Carlyle Collection is in some ways higher than the course-packet standard, and in some ways lower. Our standard is higher in that we cannot rely on a live teacher to fill in gaps in the presentation. If something need to be explained aloud, we will have to provide audio. If something needs to be acted out, we will have to provide video. If an experiment needs to be done, we will have to explain how to do it. If a simulation needs to be run, we will have to provide an applet to run it. If a program needs to be written, we will have to provide a programming environment in which to run it.

On the other hand, our standard is lower in that we stipulate that our intended audience consist of bright and curious persons. An organized course typically aims to produce some effect in students who fail to measure up as bright, or curious, or both. Whether this represents a reasonable goal is not something we wish to argue. We just want to make clear that it is not our goal here.

Our standards aren't meant to be impossibly high. By 'bright', we don't mean ' brilliant': if a really bright person 'doesn't need to be told twice', then you could say that the bright persons we have in mind don't need to be told four times—or at least not usually. Curiosity is as important as luminosity here, and as always an ounce of curiosity is worth a pound of luminosity. We want to provide opportunities for people who *want to know*.

What kind of 'online materials' will we provide? In the long run, we expect to be able to provide a wide range of materials, including text, graph-

ics, audio, video, simulations, programming environments, interactive instruction, and in general whatever will aid learning. Right now the main impediment to achieving this is the bottleneck in providing video over the net. We expect that this bottleneck will disappear over the course of the five years, with rudimentary systems becoming feasible within 6 months to 1 year. What we're proposing is just on the edge of what's possible. It's high time to get going!

Plans

In this section I will describe plans for a pilot Carlyle Collection dedicated to certain branches of mathematics. The idea is to produce materials that are valuable both in their own right, and as an example of what is possible. Seeing is believing: With a working prototype system, it will not be necessary to argue why 'live' lectures are really deader than recorded lectures, because it will be obvious. We are convinced that if we give a clear demonstration of the great potential value of the Carlyle Collection, others will be inspired to extend the collection into areas far beyond our own competence.

Please note that the plans describe here are tentative, and subject to change without apology.

Form

Let us begin with the question of the specific kinds of online materials we expect to provide. Obviously we will have text and graphics. Just as obviously, we are planning to provide video as well. As explained earlier, we expect the bottleneck to providing video to disappear over the next 5 years or so. Beginning in about 6 months, videophone capability will become standard on mainstream personal computers. The videophone system will provide audio and low-resolution video at between 4 and 12 frames/second. This system uses a 28.8 kilobit/second modem, and we know from our own experiments that it is already possible to achieve a 23 kilobit/second transfer speeds from a server in New Hampshire across the internet and over a 28.8 kilobit/second modem connection to a home computer in California. This means that there should be no impediment to providing rudimentary video over the net within the next year. Farther down the road, we expect that within 3 to 5 years

improved bandwith on the net and widely available high-speed connections to the home will make it possible to transmit high-resolution video. We plan to be ready.

As indicated above, we also envision truly interactive materials, primarily simulations and programming environments of various kinds. The computing needed here can be carried out locally (Java applets), or on some central machine. This is an aspect of the technology that is changing rapidly, and it is probably not worth going into too much detail.

Content

Here are some possible branches of the collection that might be appropriate for a pilot project. All are areas that we hope to see developed before long. Which of these possibilities we pursue will depend on who's paying, and how much they're paying.

The Finite Math Collection

In the 1950's Kemeny, Snell, and Thompson brought forth a new math course called Finite Mathematics, a hodge-podge of mathematical tools and ideas held together by their common orientation to finite or discrete problems, as opposed to the infinite or continuous problems addressed in more conventional mathematics courses like calculus. Specific topics included basic logic, probability, statistics, and computer programming. Finite mathematics is the mathematics of the information age, which was just getting under way when the course was developed.

In 1950 the only way a course like Finite Math could propagated itself was via printed textbooks. Kemeny, Snell, and Thompson's 'Finite Math' was a best-seller, and the course spread widely. The book went through a number of editions, but it is by now out of fashion and out of print. The book is out of fashion because the topics it covers are currently not usually collected together in a single course like the original Finite Mathematics. Whether the dispersion of the finite math material into courses like logic cognitive science, probability, discrete math, combinatorics, and computer programming represents a step forward or backward is not something that we have to settle here, because by its very nature the Carlyle Collection is not tied to a specific division of subject matter into courses. All we need to

recognize is that the material is as relevant today as it was 40 years ago, and that while parts of the book need updating—in particular the parts about computer programming—the book can serve as a solid core on which to base the Finite Math branch of the Carlyle Collection.

We are extremely fortunate to be able to supplement the online text of Finite Mathematics with extract from Kemeny's lectures on finite mathematics. When Kemeny taught Finite Math for the last time in 1981?, Anne Huggins wisely arranged for his lectures to be taped. Kemeny was a phenomenal lecturer, and these tapes represent a marvellous resource. Not all Finite Math topics were covered in these lectures, and some topics were covered in a way that depended on the particular arrangements of the course, or the particularities of the computer system being used. Nevertheless, the tapes are great, and will make a dynamite combination with the text.

The Chance Collection

This branch of the collection will be dedicated to allowing people—'bright and curious' as ever—to explore the role that chance plays in their lives. The inspiration for this branch of the collection comes from Laurie Snell's Chance Project. The Chance Project was dedicated to developing an innovative course called 'Chance', addressing probability and statistics issues in the news. Materials developed for this course will provide a starting point for the Chance Collection. We envision extending these materials in new directions, in conjunction with the development of a new course called 'Odds and Ends', which will explore gambling in all its guises

We expect to tie the Chance Collection in with the probability component of the Finite Math Collection. We also hope to interface to Grinstead and Snell's online masterpiece 'Introduction to Probability'.

Interactive materials will play an important part in the Chance Collection. Examples include online demos of chance concepts, and rudimentary statistical programming tools, implemented as applets.

The Geometry and the Imagination Collection

Preliminary versions of materials for the ground-breaking geometry course 'Geometry and the Imagination' have been available online for some time. We expect to work over these materials to make them suitable for the Carlyle

Collection. We are fortunate to have available many hours of tapes of John Conway lecturing on topics directly related to this course. Another source of material for this collection is a series of ten lectures on related topics given by Michael Freedman (these tapes are technically flawed, but still inspirational). We expect that by linking the videos to the text, we can come up with a set of materials that will make this innovative approach to geometry accessible in a way that has not been possible up to this point. This should also allow others interested in teaching the course to do so without the great store of previous knowledge that is needed to use the sketchy materials that are currently available.

Collections of Opportunity

We expect to make other materials available as feasible, without committing ourselves to the kind of completeness that we will be striving for in collections to which we have made a solid commitment. One example would be Conway's lectures on the 'Romance of Numbers', which unfortunately cannot be accompanied by the obvious text due to copyright restrictions. Pretty much anything useful that we can easily provide will be fair game.

Funding

This project is going to take money. Probably less than you imagine, at least to start out, and certainly less than what is routinely squandered on projects that (I should say) are worth a good deal less than this one. But there's no denying that we will need cash. I'd rather not get into specifics here.

Seeds

To round out the picture, I want to explain some of the seeds from which this project has sprung.

Feynman

Twenty years ago, I saw a series of films of public lectures given by Feynman (not the capital-L Lectures on which the books were based, but some other

ones). It took only a couple of minutes of watching Feynman on film to convince me that this was where lectures belonged. If only we could get hold of these lectures for the Collection! If only CalTech would let us use the audiotapes of the capital-L Lectures! I understand that photos were taken of the blackboard during the Lectures. If so, these could be combined with the audiotapes to make a vastly valuable resource ....

Annenberg

The Annenberg/CPM project has made a number of wonderful video series, spanning a variety of subjects. The series from Annenberg/CPB with which I am personally familiar are 'French in Action' (an introduction to French), 'Destinos' (an introduction to Spanish'), 'The Mechanical Universe' (an introduction to physics), and 'Against All Odds' (an introduction to statistics). All are glitzy broadcast-quality productions. All have accompanying texts and other materials that are sold by commercial publishers. All are really great, and would be perfect for the Carlyle Collection. All are very expensive, and likely to remain so.

I personally picked up a lot of Spanish very quickly and painlessly from the 'Destinos' series. I am convinced that if 'Destinos' and 'French in Action' were easily available over the net, along with online versions of the accompanying texts, audiotapes, and other supplementary materials, that this would contribute hugely to the teaching of foreign languages in this country. I expect that this is not about to happen. The reason I think it won't happen is that I think that Annenberg/CPB will feel it necessary to continue to collect large royalties for the use of these materials, to try to recoup some of the large cost that was spent on producing them. Another reason is that I expect that Annenberg/CPM will not be able to get permission to use the accompanying texts from the commercial publishers that publish them. I don't know any of this for a fact, and I would dearly love to be wrong...

Or take 'The Mechanical Universe'. This is much closer to the kind of thing we are going to be doing with the Carlyle Collection, at least at the outset. A typical show in this series of 52 half-hour programs begins with Prof. Goodstein of CalTech addressing an audience of actors pretending to be CalTech students. After some introductory remarks, Goodstein disappears, and the audience is treated to a series of historical reenactments, shots of old scientific apparatus, animated equations, and computer graphics all of which

are very professionally done, and really quite inspiring and useful. Then, at the end of the program, we cut back to the phoney class, and Goodstein sums things up. On the board behind him, you see diagrams and equations from the lecture he supposedly gave during the 23 minutes or so that we were watching the glitzy stuff. Now, I don't know if Goodstein gave that lecture, but I do know that I sure wish that he did, and that they had set up a camera so that we could watch it. Probably it wouldn't appeal to the mass audience that the series is meant to appeal to, but probably doesn't. What is sad is that Goodstein has probably given that lecture a dozen times during his years at CalTech, only nobody has ever bothered to record it. Recording it would have cost some trivial fraction of the cost of producing the glitzy series, but nobody did it. Why? Why? Is it because people's minds are so rotted by commercial TV that they can't even imagine making a video if it isn't going to look as glitzy as 'Miami Vice'? Those dancing equations are great, but it would be much much more useful just to have home videos of the lectures. Put them up on the web, along with the accompanying text, and bright and curious persons all over the world will be able to learn physics. Put up the dancing equations, and it will be even better, but home videos of the lectures would be much more useful, and much, much, much cheaper.

The same kind of thing goes for 'Against All Odds'. Here the story is even sadder. I heard that the rights to this have been bought up by an entrepreneur named Velleman, who plans to sell them with his statistical package Datadesk. I hope this is just an ugly rumor....

The saddest thing about all this is to think of how little has come out of all the money that Annenberg must have sunk into these productions. Ten times as many more useful series could have been made for a small fraction of the price! Of course they would have been useless to Annenberg's partner CPB, because they would not have been up to 'broadcast quality'. Once the possibility of distributing lectures over the net becomes apparent, maybe these guys will take note. Probably the best thing we can do with the Carlyle Collection is to show Annenberg what is possible. Even a small fraction of what they have spent on these big-budget productions could do vastly more to promote education than what they have done so far.

My conviction that Annenberg could have accomplished a lot more for a lot less if only things had been done differently was certainly a key element in my thinking about the Carlyle Project.

Kemeny

It is high time to talk about the influence of John Kemeny. John Kemeny was a philosopher, a mathematician, a computer pioneer, and the nth President of Dartmouth College. He was also a dear colleague and friend. The project outlined here owes everything to John Kemeny, and my first thought was to call it the 'Kemeny Collection', in honor of John. In the end, I have reluctantly decided against this, for reasons that I will explain presently. First I want to make clear the many ways in which John's words and actions have influenced the shape of this project.

John's visionary article on 'The Library of the Future' has served as a goad for us in launching this project. This article portrayed an electronic world where any book would be available immediately. The failure of technology to meet the predictions that John made half a century ago has been a considerable disappointment to me, and this project hopes to help in making John's vision of instant access to information a reality. Where John was thinking about books, we are thinking about more general materials, tailored to a more specific purpose. Still, the original vision came from John.

As the co-inventor of Basic and the force behind the development of the world's first working time-sharing system, John did more than anyone I know to bring the power of the computer available to the public. His vision of universal access to computing had a profound effect on my own life. I see this project as an extension of John's commitment to universal access. Here the emphasis is on information, rather than computing, but the motivation is the same, and the inspiration comes from John.

John's life centered around education in general, and teaching in particular. Teaching was a cornerstone of John's life, and as a lecturer John was unsurpassed. In bringing lectures to the net—and in particular, John's lectures—we hope that we can promote teaching in a way that we could never hope to do through our own classes.

For all these reasons, we wanted to call this the 'Kemeny Collection'. However, on reflection, we realized that this might not be wise. What if the project should fail, or just turn out so-so? With very few exceptions, every project that John turned his hand to succeeded far better than anyone would have expected—anyone but John, that is. If we call this the Kemeny Collection, we put ourselves in a position where anything short of overwhelming success will look like a failure, and will make a painful contrast with what we

wanted to express in naming the project for John. For this reason, we have reluctantly decided to call this the 'Carlyle Collection'. In five years, if we decide that the results are worthy of John, we can rename it the 'Kemeny Collection'.

Carlyle

Finally, a word about Carlyle. When I began this manifesto, I knew nothing of Carlyle's argument beyond the well-known phrase, and the date of its first publication. What his argument must have been, I made up to suit my purpose. Now that I have had the chance to go back and read his argument, I am both elated and depressed. I am elated to find that Carlyle's argument is exactly what I had hoped and expected and claimed it to be; I am depressed for exactly the same reasons. In 1840, Carlyle found that the University had failed to adapt to the technology of the Nineteenth Century. In 1996, we find that the University has *still* not adapted to the technology of the Nineteenth Century, much less the Twenty-first! Of course we knew that already; that, after all, has been the whole argument here. Still, it is depressing to find the problem so clearly perceived, and so clearly stated, so very long ago:

> To look at Teaching, for instance. Universities are a notable, respectable product of the modern ages. Their existence too is modified, to the very basis of it, by the existence of Books. Universities arose while there were yet no Books procurable; while a man, for a single Book, had to give an estate of land. That, in those circumstances, when a man had some knowledge to communicate, he should do it by gathering the learners round him face to face, was a necessity for him. If you wanted to know what Abelard knew, you must go and listen to Abelard. Thousands, as many as thirty-thousand, went to hear Abelard and that metaphysical theology of his. And now for any other teacher who had also something of his own to teach, there was a great convenience opened: so many thousands eager to learn were already assembled yonder; of all places the best place for him was that. For any third teacher it was better still; and grew ever the better, the more teachers there came. It only needed now that the King took notice of this new phenomenon; combined or agglomerated

the various schools into one school; give it edifices, privileges, encouragements, and named it *Universitas*, or School of all Sciences: the University of Paris, in its essential characters, was there. The model of all subsequent Universities; which down even to these days, for six centuries now, have gone on to found themselves. Such, I conceive, was the origin of Universities.

It is clear, however, that with this simple circumstance, facility of getting Books, the whole conditions of the business from top to bottom were changed. Once invent Printing, you metamorphosed all Universities, or superseded them! The Teacher needed not now to gather men personally round him that he might *speak* to them what he knew: print it in a Book, and all learners far and wide, for a trifle, had it each at his own fireside, much more effectually to learn it! — Doubtless there is still peculiar virtue in Speech; even writers of Books may still, in some circumstances, find it convenient to speak also, — witness our present meeting here! There is, one would say, and must ever remain while man has a tongue, a distinct province for Speech as well as for Writing and Printing. In regard to all things this must remain; to Universities among others. But the limits of the two have nowhere yet been pointed out, ascertained; much less put in practice; the University which would completely take-in that great new fact, of the existence of Printed Books, and stand on a clear footing for the Nineteenth Century as the Paris one did for the Thirteenth, has not yet come into existence. If we think of it, all that a University, or final highest School can do for us, is still but what the first School began doing, — teach us to *read*. We learn to *read*, in various languages, in various sciences; we learn the alphabet and letters of all manner of Books. But the place where we are to get knowledge, even theoretic knowledge, is the Books themselves! It depends on what we read, after all manner of Professors have done their best for us. The true University of these days is a Collection of Books.

(From Thomas Carlyle's lecture 'The Hero as Man of Letters', delivered Tuesday, 19th May, 1840; this was one of a series of lectures on 'Heroes and Hero-Worship'.)