THE OZYMANDIAS PROJECT

To save the Literature, Art, and Science of our Civilization for the ones to follow.

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Ozymandias

I met a traveller from an antique land
Who said: "Two vast and trunkless legs of stone
Stand in the desert. Near them on the sand,
Half sunk, a shattered visage lies, whose frown
And wrinkled lip and sneer of cold command
Tell that its sculptor well those passions read
Which yet survive, stamped on these lifeless things,
The hand that mocked them and the heart that fed.
And on the pedestal these words appear:
`My name is Ozymandias, King of Kings:
Look on my works, ye mighty, and despair!'
Nothing beside remains. Round the decay
Of that colossal wreck, boundless and bare,
The lone and level sands stretch far away.

Percy Shelly

THE OZYMANDIAS PROJECT

All that we have of the ancient civilizations that preceded our own are tatters and little pieces. Whatever remains of literature, music, art, or even architecture we have managed to find are but a microscopic sample of what was there when these civilizations flourished. As the civilizations become more ancient, the remains become more fragmentary and faded. What is preserved is done so by processes which work mostly at random, and therefore the best is usually lost. We have only hints of the magnificence of the former great cultures, hints which still enthrall us, but we are looking at

shadows.

The artistic riches of King Tut which so shocked the world were those of an extremely minor Pharaoh. We have never seen the undisturbed tomb of a mighty one. We know also that the Greek tragedies that have survived are but a fraction of what was produced by their authors. The ones that we have were considered by contemporaries to be the lesser ones. It is universally recognized, however, that even the fragments of Greek and Roman civilization that were carried down the time stream played a pivotal part in the development and history of the western world. The Renaissance was a rediscovery and extension of the ideas, art, and science of the classical period.

This brings us to our own place in the time river. What should we preserve? What can we preserve? In our own time a tantalizing possibility has arisen: Our civilization has now in its grasp something denied to all previous cultures. We can, if we wish, save our best works of art and music for thousands, hundreds of thousands, or possibly millions of years. It is now possible to save not just the written word (the Sumerians were remarkably successful at this with their clay tablets), but also painting, photography, sculpture, music, and dance. Should we attempt this? I think we should. The legacy we ourselves have been able to preserve from the past is of inestimable value. Our own civilization would be no less valuable to those who will follow us. This is true not merely from a standpoint of "progress" which is a problematic concept, but from the view that for future generations to lose all of Beethoven, Van Gogh or Shakespeare would be a loss of irreplaceably unique products of the human spirit.

Can we Prevent this loss...yes it turns out with a little thought and effort we can.

I am proposing that an international institute be set up to implement this project, which I have dubbed the Ozymandias Project (from Shelley's poem), for the sake of extracting the maximum irony from the situation

Two Possibilities

There are two entirely different modes of the Ozymandias Project, for the two main possibilities of what will befall our civilization: The first project is for the eventuality that our civilization continues into the far future in an evolving but continuous way. The second eventuality is that our civilization does what all previous civilizations have done; which is gradually or rapidly cease to exist.

The first mode I call the Ozymandias Archive

The second The Ozymandias Project Time Capsule.

The Archive project

The Archive Project is simplicity itself, readily achievable with current technology. It could be done at no greater expense than maintaining a large library, and it would serve a double function because it could be used as an electronic reference library by the general public, while serving its true function of keeping our civilizations works intact.

Let us say for the sake of discussion that our present civilization, (which is worldwide now), continues to exist without major interruption for the next 50,000 years. An institution would be set up (preferably under international direction), as a permanent repository for all the best works dating back to the Greek, Egyptian and Chinese beginnings, and including current works as they are produced.

The Archive would be an ordinary office building, or to resist minor disturbances a particularly sturdy one in a rural or suburban setting. It would have an ordinary office staff whose jobs would consist entirely of archiving and periodic recopying.

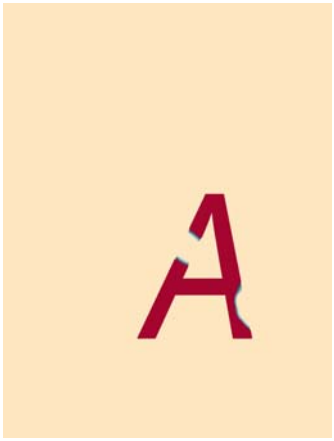
The Archive technology

The key to the possibility of a truly permanent archive lies in current digital technology. The central concept is very straightforward: Information can be stored in only two possible manners: analog and digital. Analog information must, in the course of time, be lost, digital need not be. A photograph of a painting is an analog storage method. A piece of music stored on a phonograph record is also analog. In the case of the photograph, small areas of colored dyes correspond to the original distributions on the painting. If the painting is representational, then it could also be considered an analog representation of the original scene, with areas of paint representing colors and shapes of the original subject. In the case of the music recording on an L.P., the width of the grooves represents the loudness at each point, and the density of the undulations represent the pitch of each note. All information that is stored in an analog way must eventually be totally lost. This is an unavoidable and inflexible constraint on this mode of recording. The painting will deteriorate, and a thousand or certainly a million years from now it will be dust. At first one might think one could get around this by taking a photograph of the painting when it was new, and then simply re-photographing the photographs every few years before they faded. Unfortunately, every time you make an analog copy, you lose a small amount of information. In the case of a photograph each successive copy is slightly fuzzier then the one before. The thousandth copy would be very indistinct. By the millionth, it would be unrecognizable. In information theory this is known as adding noise to the signal, and it is theoretically (and practically) impossible to make an analog copy without adding noise. If we take the

example of a phonograph record, then the millionth copy of any piece of music would simply sound like a steam kettle hissing (called white noise by audio scientists).These conventional ways of recording music and art would lead at last to their ultimate total loss.

The digital mode of information storage is quite different. This method is the one ubiquitously used today in such technology as digital audio disks (CD's), Digital video disks(DVD's), hard disks in a computer, However, digital storage is not new, it is, in fact, a method in use since the invention of writing. The term digital is somewhat misleading, actually, in this context it has no necessary connection with numbers. Digital information storage is just storage where an arbitrary unit (a mark, a stick, an indentation in a clay tablet) represents something else. Any alphabet is in this sense digital. When copying information represented in this form, the mechanics are altogether different. If you take the word "ALBATROSS" and copy it over and over again there is no necessity to lose information. An A is either an A or not.

If you have an A in an old manuscript with a piece missing, and a patient monk is making a copy, when he sees:



He recopies it as " A ". The copier is not copying the appearance of the letter, but only which letter it is. Therefore faint or partial letters are reborn as new ones. The "erosion" is not passed on to the copy.

So, unlike analog copying there is no mathematical necessity to loose information every time a single letter is copied. And, if mistakes are made in the sequential copying of millions of letters, such that one letter is substituted for another, they can be corrected by some tricks which can only be used on digitally stored information.

The correction trick works as follows: lets say you are copying the word "ALBATROSS".

1) The first step is to copy it ten times.

Each time must be independent, based on the original and not a copy of a copy.

2 Now store all copies.

3) When its time to recopy (say twenty years later), compare each letter in all ten copies and recopy the letter that is in the majority, to create a master copy.

4) now make ten (again independent) copies of this master copy. Store all of them.

5) repeat

In this process every time a random error is introduced it is corrected by the majority. The chances that for a given letter six out of ten copies would give the same error and produce a different letter are remote. If you want to make the chance close to zero make 50 copies.

For Humans this would be insurmountably tedious but this is what computers are born to do, with current computers every letter in a novel could be compared with ten copies in a few seconds.

So in our Ozymandias Archive the clerks dutifully instruct the computers to periodically recopy their entire archive say every decade before the storage media degrade. Each new copy is made by comparing ten old copies digit by digit.

This also gets around notorious difficultly with digital media obsolescence. It doesn't matter at all here, that the machines which read the storage media. or the media themselves, change rapidly as technology advances, because each set of copies can be copied unto new media with new technology. As soon as technology changes the clerks automatically recopy the archive onto the new media, using the readers already in place to decode the old media. As media change new readers are simply acquired. There would ,in this system, be no very old copies in unreadable formats, all you would need to preserve would be the two or three most recent technologies.

Literature would of course be the most easily encoded this way (In fact writing is encoded into a string of ones and zeros every time one uses a word processor.) Painting, photography and even sculpture in its full three-dimensionality could be encoded this way by scanning it with light sensors. Movies and video be can be reduced to such a digital form, or, with recent electronics are originally produced in that form. This is how all the graphic material you see on the Internet is sent to you.

All this information, from all these disparate sources, could be duplicated and compared "dot by dot" by computer before recopying. Thus could be preserved indefinitely not only Beethoven's music, but Beethoven's music as interpreted by current musicians. Ten thousand years from now people could listen to Charlie Parker, Glenn Gould, or Jascha Heifetz as clearly as we can today. (Better, if their stereos have improved).

What should be saved?

Now that I have indicated how we can actually do this, I think we can lay out the following broad outline for the Ozymandias project:

An international committee would be set up to answer the following questions:

1) How far into the future can we feasiblely attempt to preserve our works? (I think ten thousand years is a minimum goal.)

2) What is the best and most cost effective technology out of the many available?

3) What should we choose to preserve?

For the Archive project conventional magnetic or optical disk storage would be most cost effective. The office structure would be very inexpensive; once the original work involved in gathering and inputting the material is finished, it would probably cost less to run than a single post office for a middle-size city. Technology would be upgraded to newer standards periodically.

The last question is how the selection of the "forever file" is to be chosen. Interestingly enough, if the first scenario is in effect (the office building, in an uninterrupted civilization), then, surprisingly, the best way to choose which works deserve semi-immortality may be not to choose at all. Current technology has already produced miracles of compactness. It has achieved information densities of 100 billion bits per square inch in magnetic recording. Using micro pointed needles (Atomic Force Microscope) technology, they have been able to achieve ten times that density on a plane surface. Optical researchers have now begun to exploit the potential of using three dimensional rather than flat mediums to store data. Using lasers to create microscopic irregularities in solid crystals and polymers, they have demonstrated densities of about one trillion (1,000,000,000,000) bits per cubic centimeter (16.3 trillion bits per cubic inch). Each letter of a word takes up about one byte or eight bits. A pixel takes from one to six bytes to store. At this density, a library's worth of words would fit into a sugar cube, and all the world's written literature, in all languages, could easily fit into a shoe box. It might be cheaper (and certainly more egalitarian), to simply encode all the books ever written, and all the music now known, a selection of the photographs, and all the well known paintings, into one huge data base. This might be cheaper and quicker than it would be to hire many thousands of professors and experts who would acrimoniously debate the relative merits of each book forever. We could simply save all of it, including ten redundant copies, in a cube the size of a refrigerator and let poor posterity decide which of it is any good. Movies and even television could also be saved, but this would require millions of times more storage space (and television would raise certain embarrassing questions about our taste, or even our sanity with our decedents).Still, if we desire it, there is no technical reason why "I Love Lucy" could not sit magnetically encoded in the lap of Faust

.

The Ozymandias Time Capsule

In the Eventuality of the Fall of Civilization

This scenario, however, is probably unrealistic. The oldest continuous civilization so far has been the Chinese, which is about 5000 years old. Most other civilizations have lasted at most for 3000 years, and there is no particular reason to believe ours will last longer.

The discussion here is not about our present civilization collapsing very soon, something I, (for one), am neither anticipating nor looking forward to, but from the perspective of truly long vantage points, (geological or even biological), civilizations are ephemeral, and if our particular one lasts 20,000 years, that is still a blink.

Even if global civilization does fall, with any luck, there will be humans around, and it is for them this project is conceived.

In the event of a real collapse, and a return to bronze or iron age technology, the storage site would have to be self-maintaining, very difficult to get into, and not dependent upon trained and willing personnel to insure its continuity. There will be no copying of records in that world. If we are so ambitious as to want to bequeath our works to very distant generations, say 100,000 or 1,000,000 years into the future, we will have to prepare for some pretty rocky times between now and then.

What is needed for this world is an extremely well fortified and even better hidden vault. Something that will be barbarian proof. The idea of this Ozymandias project is to sleep beneath the sand unfindable and impregnable, for enough thousands of years for a new advanced civilization to arise. We want something that would completely evade, say, the Romans, but present itself immediately to any civilization, at our level or greater.

Then in the vault you have something which gives a decodable, intelligible, record of our best achievements, in a form that will last for hundreds of thousands of years.

This is not as hard as it sounds.

To address the physical site problem here is one possibility:

Dig a really deep hole in very hard rock go down say 1000 feet. Place your project in a hollow at the bottom. Now back fill the hole with the diggings up till about 200 feet of the surface then pour molten iron in for 100 feet or so to make a plug no non-technological people can get past. Fill the remaining 100 feet with dirt cover with soil and landscape it to look like the surroundings.

It will soon disappear from human ken. If accidently found, it will be impenetrable.

However, when and if technological civilization re-arises, it will stand out like a sore thumb. Any geomagnetic mapping satellite (one of the first kind we sent up) will go off scale when it passes a piece of purified iron that large.

Then any self-respecting technological civilization would dig through (or around) the plug and enter the chamber. We could see to it in the next stage that would be well worth their while.

Carl Sagan when presented with the idea for the project came up with a fascinating alternative for a site, (from the perspective of an astronomer): put the whole project in space i.e. place the Time Capsule in Earth orbit, and only advanced civilizations can get to it, furthermore, it will be easily found and decoded by them. for more information on this idea see link

HISTORY OF PROJECT

Technology of millennial storage.

Lets assume for the sake of discussion we want to save our culture for 100,000 years.

First no conventional storage media are of any use at all. Plastic based materials such as CD's would be dust, as would hard disks made of steel. Paper books likewise would be dust.

The practical answer to the question of how to preserve a Rembrandt for one million years is a bizarre mix of the very modern and the very ancient. The method owes as much to Sumeria as the computer chip. The key is that the information is digitally encoded, but on such stable materials that it can last indefinitely with no further copying.

A possible example would be the following:

Then take an extremely durable material like ceramic (the Sumerians used clay tablets), or quartz or granite. Drill, chop or shape the material to encode the digital sequence. Take the slab and drill micro holes in it, with a hole representing zero, and any space between the holes representing one:

00 000 0 0 0 00 00 0

A high power laser could make the holes microscopically small to achieve high information density.

Quartz would probably be best because being crystalline it would undergo the least shift in shape over time. Now fill the holes with black glass such as obsidian. This is so a future laser reader skimming the holes will register the pattern of light and dark as ones and zeros. The glass can be engendered to have the same thermal expansion as quartz so that there will be no stresses introduced (and

therefore no wear) from heating and cooling.

You now have a material that encodes the information and isn't going anywhere. Such a slab, left in a stable geologic formation might keep the information intact for a million years or more.

Now make ten copies of each record, This is not because while the project sleeps under the sand, there will be any copying, but because when far posterity digs it up they can use the digital error correcting technique outlined previously to get a flawless copy even if there has been some small degradation in some of them over time.

You can make certain reasonable assumptions about the people 100,000 years from now:

1) if they can get to your vault they are a high order technology they will have lasers to read your slab library and an understanding of binary codes.

2) on the other hand, they will not be speaking English or any other present day language.

Not even close. (Try out your knowledge of Aramaic or LinearB for example, and that's from only five or six thousand years ago.)

The hardest part of getting your information decoded in the future will be the *initial* communication with our far decedents. Telling them what they have found and how to read it.

We need a Rosseta stone, but a Rosseta stone that will work when ALL present languages are dead.

for this we must rely on the oldest and most universal communication possible: drawings,

(Really cartoons). Recognizably human figures acting out situations and giving instructions. I believe that even 100,000 years from now humans will understand cartoons much the way we do. If they don't then they may no longer be human enough to relate to any of our art music or literature anyway. So a cartoon instruction stone is our best hope.

After the considerable challenge of getting to the hidden vault is overcome, and the door to the chamber opened, our decedents would be presented with an immense collection of quartz sheets or disks, (which could be as thin and small as CD's) and in front of them say 500 large stone slabs inlayed with deeply carved cartoons. The cartoons will be a carefully thought out sequence depicting people of a long forgotten age depositing their art, music (a cartoon of a person playing an instrument) and literature (a cartoon of them writing) and then pointing to the quarts slabs. A basic vocabulary would be worked out (our present day linguists would try to work out the best way of doing this). Numbers and common nouns would be established. (Everybody will know a dog and a cat etc).

It would be provident to have a t least one duplicate set of these

instructional cartoon slabs in case some get somehow damaged or degraded.

Last but not least, binary coding will be depicted, laser frequencies given, and the fundamental formatting with which the slabs can be decoded (which ones are pictures, which writing, which sound)

The first digital slabs will be tutorials.

This is a boot strap process once the first digital slab is decoded it can give thousands of pictures (not cartoons but detailed photographs) to illustrate a basic vocabulary to build true communication. With a few thousand pictures you can go from the dog and cat level to what our cities look like, transportation, vehicles, and subtle emotional states like elated or amused.

Once they get the decoding straight, the material will start to unfold.

They will have something before them utterly different than what we have ever had. They would have a true window to the past. They could hear our musicians play and watch a movie of rush hour in New York, or café's in Paris.

The Music and Art will be self-explanatory although cultural shifts may make them hard to understand . Some of it, like Mozart and Michelangelo I think will be instantly recognizable, and even moving, to any of our decedents no matter how far down the time stream. Ives and Picasso may take a little more work , but for all we know it could be the reverse.

Literature would probably present the most serious difficulties, because The subtitles of language would be the hardest to convey with no living language to link the far past to our decedents. Still, although Shakespear might loose much of what makes it unique "what fools these mortals be" will probably get through.

It is a strange thought, to think of a bunch of researchers in 103,000 years from now in a cavern 1000 feet below ground, standing next to an improvised decoder made out of a laser, photodetector, amplifier, and speaker and listening to Beethoven and then Miles Davis. What brave new world indeed.

Our Science and Math need to be saved too. Although any civilization which can enter and decode the capsule will by necessity have a high technology, there may be gaps in their science that we would fill in. (It is possible to imagine a science with a fair degree of physical sophistication but without any knowledge of DNA for example). Even something like General Relativity may not exist in the future, being an example of a unique approach and quirky viewpoint. Our Mathematics too, may have looked into areas that other civilizations will not have. (Group theory for example, may be never invented again).

In this, more circumscribed, project, only a small representative sample could be preserved, along with the necessary decoding Rosetta stones. An international committee would be set up which

would take (I assume), many years to resolve what is truly great and worth saving. Written works take up the least storage space and therefore most of world literature could probably be saved without using a prohibitively large space. Although our music and art would be somewhat culled, we would nevertheless be able to preserve a vastly more complete and representative sample of our best than we have ever received from any previous civilization, and it would be passed down in pristine exactitude, not in faded, ghostly suggestions

It is critical to understand that All the techniques described above are quite feasible, they are based on current technology, and could be done now. The truly permanent storage of data has never been thoroughly researched, if it were, one could expect new techniques for storing information for hundreds of thousands of years, much more cheaply and with higher information densities than are remotely possible with current technology. This would only be a parallel development to the progress which has been made in the technology of temporary information storage which was brought about by the advent of computers.

Why?

We should begin to look seriously into what would be necessary for this effort now. The motivation for doing this boils down to the subtle but deep feeling that the accidents of time, culture and individual spirit that give rise to the creation of a great work can never happen twice. That some of what we have, be it Hamlet, or Beethoven's Ninth Symphony, is simply so inherently wonderful, so beautiful, or so wise, that it constitutes a gift to future human beings worth great effort to bestow.

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