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REPLY TO BREWSTER:
Where My Hypertext Ideas Came From, and Where They All Went

Theodor Holm Nelson
Internet Archive Fellow and Founding Designer, Project Xanadu¬Æ

Brewster Kahle has recently asked about the origins of my hypertext ideas. He didn't know how big the answer was. To quote the old saying (going back, I understand, to Roman times)-- here is a long piece because I didn't have time to write a short one.

Brewster's question is answered, more or less, in the first twenty paragraphs, but I thought it important to continue on and get the record straight.

I have tried to make this answer as short as possible, but I needed also to include the context of my other computer ideas and aspirations. (My actual works in other computer areas I put at the end, to be skipped if not interested.)

My personal story is deeply interwoven with these ideas, in the same way that Bucky Fuller's story was interwoven with his ideas.

However, I won't tell the personal story here, since I have already told it variously, especially in
- My autobiography POSSIPLEX available at
lulu.com/shop/ted-nelson/possiplex/paperback/product-14925222.html
- My book "Literary Machines", available in many forms
- the video "Here I Stand", showing at
youtube.com/watch?v=mmfjM-SGlGs
- my CV (summary of my work to 2011) at
hyperland.com/TNvita

So this will be a condensed version, concentrating on the aspirations and actual work, with almost none of the personal story-- where I was, jobs, writings, universitites, friends, lovers, griefs, etc.

All this may be corroborated (in principle) from my paper files of the 1960s, 1970s and since.

(Note the need for parallel timelines-- which everyone needs, and for which there are still no tools.)

=== === === TEXT IDEAS BEFORE 1960

FAMILY THAT HONORED THE WORD. In my boyhood homes, with my grandparents and great-grandparents, words (and the ideas they represented) were paramount. Shakespeare and Shaw were our household gods, we would read aloud a lot. There was constant talk about pronunciations, meanings and origins of words. My great-grandfather would recite poetry at the table.

MEMEX: In 1945, when I was eight, I think I was exposed to the Vannevar Bush memex piece in two ways-- I believe it was read aloud at our dinner from the Atlantic Monthly, to which we subscribed, when it fiirst came out in June 1945. I believe I also read it on my own, as the illustrated version that was later published that year in LIFE, to which we also subscribed. (But I did not remember it until much later, when I started to write computer articles.)

STUDYING WRITING. I was very interested in writers and writing. I read a lot of books in grade school, moving to science fiction in high school. I studied various authors-- notably L.Ron Hubbard (before dianetics and scientology), Philip Wylie, William Saroyan. (My father, whom I rarely saw, was a playwright, and had a play on Broadway in 1945, written and put on while he was in the Air Corps.)

In high school I took typing, a course which was usually taken by girls, because I intended to write a lot.

LEARNING TO WRITE, AND THE PROBLEMS OF WRITING: In high school I was required to write papers-- they would ask for ten or twenty pages but I couldn't keep from writing papers of 40 or 50 pages. The problems were--
- I couldn't bear to omit what seemed important, and so much seemed important
- rewriting was always necessary, and it turned out to be the hardest part of writing,

REARRANGEMENT turned out to be the hardest part of rewriting in hiigh school and college. (In the summer of 1960 I wrote a thousand-page novel manuscript, and rewriting it seemed inconceivable, with all the rearrangement it would require, so it still sits in its carton.)

CUT AND PASTE: In my first salaried job, as a copyboy on the New York Times, my first job was to fill the pastepots for the reporters, who would literally cut their first drafts apart and paste them together in a new order. (This true meaning of "cut and paste", and its importance even today, has been obliterated.)

My grandmother had once been to a lecture by Tolstoy's daughter, saying how Tolstoy would cut up his pages and leave them around on the floor. "Don't touch my noodles!" he would say as he went for a walk. Now, because the terms "cut" and "paste" have been redefined, I say "Tolstoy Noodles" instead.

I still do my revising from paper printout, and sometimes do a full Tolstoy noodle job, cutting the printout in sections and rearranging them, attaching them to backing sheets in the new order. Indeed, I have had to do it for this piece.

=== COMPUTERS-- FROM 1950 TO MY 1960 REVELATIONS AND INTENTIONS

In grade school (Jamuary, 1950) I read the issue of TIME with the caricature of the Mark III computer on the cover. The article was very puzzling, and I kept trying to find out what computers really were throughout high school and college. In high school I bought the "Geniac" from Edmund C. Berkeley-- it was supposed to teach "computer logic"-- but it was just a disk with jumpers that lit lights to teach binary, which told me nothing. In college I kept asking what computers were; indeed, my pal in the engineering department, Prof. Carl Barus, told me about Perceptrons. But I still had no general notion of what computers were.

In graduate school, in 1960, I took a computer course and finally learned what computers were about-- they weren't "mathematical", but all-purpose machines. I was indignant at how the public, and I, had been misled.

Then came my most electrifying insight: computers could have interactive screens! At that time I considered myself to be a movie-maker, and saw the interactive screen as obviously the next step of movies-- I realized that interactive screens would be the new home of the human race, though there were few in the world at that time. Accordingly, I started to design the documents we could have that would go beyond what is possible on paper. (To my astonishment, the tekkies who created our present document systems-- Simonyi, Tesler, Warnock-- have IMITATED PAPER, which I consider retrograde, to put it mildly.)

(Looking through my files, I have tried to find out when in 1960 I had my big insights, but I haven't found out yet. I have flipped quickly through thousands of my file cards-- my notes on computer subjects from 1960-- and have as yet found no smoking gun, no particular "Aha" moment. It is more likely to be in my diary cards of that time, which I may never have time to go through.)

I know that in early 1961 I said to Isaac Asimov at a party: "Mr. Asimov, soon we'll be reading and writing on computer screens." The Great Futurist sneered "Yeah, SURE!" His famous foresight was not perfect.

From that beginning in 1960, I particularly imagined the writing system I wanted for myself, and intended that it would become the world standard. I hoped to create the great text format and editing system of the future-- but with aspects no systems have yet, especially capabilities for massive rearrangement, and visible connections.

- ease of major rearrangement [STILL NOT IMPLEMENTED ANYWHERE-- closest is TextPad]
- management of many notes in an on-screen storm [STILL NOT IMPLEMENTED ANYWHERE]
- showing parts shared between notes and drafts [STILL NOT IMPLEMENTED ANYWHERE]

=== FIRST WILD PLAN: A Rewrite Parlor

Energized, I soon wildly imagined starting the General Creative Corporation, and I imagined opening a parlor near Harvard for what is now called "desktop publishing"-- but I believed the real problem of writing is large-scale rearrangement, which would be our main service, at that parlor.

Here's my January 1961 sketch for the word-processing parlor I wanted to open in Harvard Square.
hyperland.com/generalcreative/gcTheShop,Exterior,Jan1961.pdf

Large-scale rearrangement used to be called "cut and paste" before the Macintosh changed the meaning of those words-- it's what Tolstoy did, and newspaper reporters-- and there are still no facilities for massive, organized rearrangement in the computer world.

The company was going to be called "General Creative," and I imagined it as an Apple-like company that would bring digital creative services to the world-- writing systems, graphic services, movie making. In other words, very like the Apple image. But at that time Steve Jobs was only five years old, and there were no integrated circuits on the market that would bring the price of a computer below $50,000. But I was sure.

=== MY GRAND GRAND PLAN-- WHAT I REALLY HOPED TO DO, AND WHO DID IT

From 1960 I became wildly ambitious. I told people what was GOING to happen, but not that I intended to do these things myself.

How vast the ambitions were, and the leverage they would eventually require, were not clear-- but how could they be? I was alone in the universe with these ideas.

(As far as I know, only three people understood me in the first ten years-- my wife Debbie, and two friends-- Chuck Weiss and Walter Gross.)

I was right that these things were going to happen; everything I intended could and would be done, and all my ideas were valid. But most of my ideas were eventually implemented by others.

I did not get leverage. I never found my Wozniak (who made Apple possible), my Paul Allen (who worked with Gates to make Microsoft possible), my Robert Cailliau (who worked with Berners-Lee to roll out the Web). My many collaborators had many strengths but dropped away or disagreed. (Note that I try never to bad-mouth my collaborators, whatever they have done.)

I particularly imagined the writing system that I wanted-- for handling hundreds of notes, for massive rearrangement, and showing what parts were the same in different notes and drafts. (This I later called "transclusion", and it has many more uses.)

I hoped the writing system I was building for myself would become the world's text standard system-- the editing programs, the document format, and the distribution system for world wide hypertext, very different from what we have now.
- The standard editing program was later done by Charles Simonyi-- first as "Bravo" at PARC, and then moved to Microsoft as Microsoft Word-- but dumbed down to one column of text and the emphasis on formatting, and the clumsy .doc became the standard text format.
- The standard hypertext system was created by Tim Berners-Lee-- it was about the sixth hypertext system on the Internet-- but with a trivial structure of one-way jump-links.

I have continued to work on my alternatives for over half a century, because I believe in them strongly.

=== === == (THE OTHER AMBITIONS)

I rarely mention it, but I planned more, in those heady early sixties (though I took no other drugs than alcohol and coffee). I intended to--
- create a personal computer industry (later done by Altair, PET, Commodore and especially Apple)
- create and market a system for video editing (later done by Avid)
- create a realistic CGI system for Hollywood (later done by ILM, PIXAR, WETA etc.)
- write up the principles of interactive design for all to understand (later done by others I disagree with)
- create theatrical movies, interactive and computer-based media.

I kept working on these ambitions through the sixties and into the seventies. That other, nontextual work is described at the end of this piece.

My main emphasis was always on hypertext.

=== === === THE FIRST ROLLOUT, SPRING 1965 AT VASSAR

Early in 1965 I gave a talk at Vassar College, where I was teaching sociology, about my plans for writing systems and hypertext. It was very well attended; people knew I was intensely up to something. Much of the faculty came, on special invitation from the dean.

After that talk, few on the Vassar faculty ever talked to me again. (Debbie, my wife at that time, thinks they were confused, not shunning me.)

=== THE CONFERENCE ROLLOUTS, SUMMER 1965

I submitted papers to five conferences, and all were accepted. Only one was peer-reviewed (the ACM paper), and those reviewers were enthusiastic. The papers were (to the best of my recollection-- though they are all filed somewhere)--

- For the American Documentation Institute, "The Hypertext". This was the real professional rollout of the concept. (This was a one-pager for a small meeting.)

- For the ACM National Conference: "A File Structure for the Complex, the Changing and the Indeterminate." (This was the big rollout of the hypertext idea, with that big peer-reviewed paper.)

- For the Society of Motion Picture and Television Engineers: a plan for movie editing using computers, entitled "Computer-Indexed Film Handling". I called my system Cinenym.

- For the Society for Information Display: "Suggestion for an On-Lne Braille Display".

I also presented a fifth paper, but unfortunately at the moment I am not sure what it was. (I have previously reported that it was entitled "Realistic Pseudo-Photography by Computer", but have just found that piece dated 1968, three years later.) That 1968 paper may be seen at hyperland.com/Fantasm68
I called my photorealism system Fantasm. More on my CGI work will be found at the end of this piece.

=== === === CONTINUING HISTORY OF THE HYPERTEXT WORK

(My other computer work, outside the text field, will be discussed at the end.)

I have always been pushing toward a unfied editor and hypertext system, very unlike the designs of other people. From the beginning I intended it to become both the world's writing system and the world's hypertext system.

I have always thought of it as "a decent text editor"-- with
- major rearrangement facilities
- version management, including branching versions
- visible comparison of pieces and pages, showing what parts were the same (transclusion).

But in addition, my new form of document would be a hypertext system, with
- jump-links (like the Web-- what other people call "hyperlinks")
- visible connections between texts on the screen, followable by the user. [Nobody has yet done this yet.]

I also intended it to have an extremely fair system of content sale, with a copyright system to match. I considered it vitally important to maintain a publishing industry. [Because the world doesn't have a fair system of payment for documents, the publishing industry is being destroyed and the academic journals are being hiidden away at high prices.]

=== === === MANY ENDEAVORS, ONE GOAL

Over the years I have worked on many endeavors toward this overall system--
- text editors
- connected pages and windows
- editors with transclusion

- editors with serious cut and paste (what I now call Tolstoy-type noodles-- I would say "cut and paste" in the old sense, but nobody knows what that means any more).

These have all been parts of the one overarching design, with many adaptations.

There follows a roster of these different efforts.

=== THE FIRST ACM DESIGN

That first 1965 ACM paper, "A File Structure for the Complex, the Changing and the Indeterminate", presented a most peculiar hypertext design. It was the best I could come up with at that time. Looking back, it surprisingly precapitulates my later designs.

I called that hypertext design "zipper lists." A zipper list was a connected series of text chunks that could have sideways connections to other zipper lists. There were three types of connection--
- sequential, along the chain of chunks (typeless and directional)
- between a chunk on one list and a chunk on another (typeless and non-directional)
- identity between two chunks (which became the transclusion concept).

The idea stands interestingly. It foreshadows--
- the two connections of Xanadu (links and transclusions)
- the parallel pages of my ongoing Xanadu design
- the typeless connections between the cells of ZigZag (which are chunks in lists, though they are called cells).

(A few people wrote to me about that paper, but I was unable to keep up the correspondence.)

=== THE DARK BROWN PROJECT

Around 1967 and 1968 I worked on a project at Brown University-- unpaid, unthanked, contiinually insulted, and with my name cunningly hidden in the middle of the author list, although I wrote the first draft and supplied most, if not all, of the ideas.

The project was called HES, which stood for "Hypertext Editing System", but to my alarm people kept referring to it as "Hypertext," confusing it with the literary genre I was advocating.

Worse, the project reduced the concept of "hypertext" to jump-links, losing my idea of visible connection, which was sneered at.

It was on this project that I invented the Back Button, which was implemented by Steve Carmody. Others on the project said "no users would understand it", and I said "trust me." (Carmody also implemented transclusion for me, but it did not get into the documentation.)

Not being a quitter, I stuck with the project, and even arranged with the publishers of Nabokov's "Pale Fire" (a novel in the form of a poem with footnotes) to show it in the IBM booth at a major conference. However, IBM considered the idea too "far out", so that demo did not take place. However, my script for it can be found (in two sections) at
xanadu.com/IBDpart1
xanadu.com/IBDpart2

I am extremely sorry about my association with the HES project. Eventually I wrote to the presidents of Brown and the ACM, asking for an ethics hearing on how I had been treated, but of course got only polite letters in return.

=== THE HYPERTYPER PROJECT, ca. 1970
(This would have gotten the Xanadu trademark.)

With a wonderful programmer named Cal Daniels, I worked on a project I now call Hypertyper, though it may have had other names at the time. It ran on a very small computer (an 8K Nova) in Algol with a cassette drive, but our audacious plan was to sell the package as a complete word processor, into what was then an unoccupied market.

Hypertyper would have been a hardware package to compete with the Wang word processor in that same time frame. We finished the program but had to give back the computer when our backer backed out. I believe it was a working system-- I think Cal debugged the software on his employer's machines, contrary to my instructions.

Text contents were to be written on the tape but never changed, being rearranged by software as required. This was radical at the time.

I invented several things in the Hypertyper project--
- the principle of "write-once and rearrange-virtually"
- the enfilade, an editable tree that pointed to the text stored on tape
- the JOT interface, totally different from today's text interfaces, which automatically capitalized and uncapitalized as contents were typed and rearranged. (A later implementation of JOT, programmed by Steve Witham, can be tried at the Internet Archive, at archive.org/details/jot_0.53_ted_nelson)
- Lollipop Language, a keystroke parser with which I defined JOT. It sorts a keystroke sequence into a state machine (technically a Mealy machine). Lollipop language is defined at xanadu.com/lollipop.pdf

There is a curious relationship between the enfilade, the editable tree of the Hypertyper project, and the Piece Table, invented at Xerox PARC. Both of these use the principle of "write once, rearrange virtually," and Bill Duvall says he had tried my method while he was at PARC-- there is the piquant possibility that they got it from me, but I have no further information. (As I understand it, the piece table is a system of indirect editing which is the basis of many modern text editors, including Microsoft Word.)

=== === === THE 1979 XANADU PROJECT

The historic pinnacle of the Xanadu project was not till five years later.

Through the summer of 1979 I worked with five brilliant guys. I laid out what was needed, and they figured it out. The team was
- Roger Gregory, technical lead
- Mark S. Miller
- Stuart Green
- Roland King
- Eric C. Hill

Together we worked out the structure of the canonical Xanadu design. We called it xu88 because Roger believed it would take nine years, and he was right. (It is now called Xanadu Green.)

In 1988, xu88 did indeed get backing and was almost finished. The disaster is discussed elsewhere.

=== BASIC CONCEPTS OF XANADU GREEN, USED IN LATER VERSIONS OF XANADU

The basic concepts of Xanadu Green have continued to be fundamental to all Xanadu designs from 1979 to today (38 years and counting)--
- the EDL, or Edit Decision List
- overlay links
- transclusion
- microsale of content (and corresponding copyright license)

I will cover these briefly.

EDIT DECISION LIST, OR EDL. A document is not a lump file., but a series of portions to send for and assemble. What is sent to the user's machine is a list of portions to be sent for. The user's machine puts them together and shows them.

Edit decision lists are standard in Hollywood-- the EDL has been the standard method of video editing since the 1970s, completly independent of our project. (We did not use the term in 1979, but chose the method independently; I have adopted the term in recent years.)

OVERLAY LINKS. Our links are separate objects, not embedded, which are overlaid on the resulting document. Thus many links may overlap, from different sources, on the same document.

More recently I have been calling these xanalinks, or Xanadu links, because the embedded links of HTML have so confused people. The term "overlay" is also appropriate.

TRANSCLUSION. The same content in two places, from the same source, is called transclusion. (Youtube screens, embedded in email or web pages, are transclusions.) Xanadu Green would be able to show the transclusions between different documents and versions.

MICROSALE BY THE CHARACTER. Publishers could of course give contents away free, but with the same EDL mechanism they could charge for contents.

Payment would be for the portions that are sent for-- not bought as a whole document, but sold by the character. This meant that contents could be freely quoted (by listing them in the EDL), and huge chunks could be quoted by anybody without negotiation. A user who did not wish to pay for the quotation would not receive it. This would work both for whole documents, and for quotations of any length within other documents.

This seems completely fair. It would legalize mashups and mixes and anthologies of all kinds, with minimal complication.

The idea has been criticized as blocking fair use, but fair use always begins with a legally purchased copy. Anyone legally purchasing content could quote it in small pieces in their own way, which is how fair use works.

TRANSCOPYRIGHT. This of course requires a different copyright license, called "transcopyright" since the 1990s. (Present version at xanadu.com/xuTco.html). Note that transcopyright was briefly the official permission system of the ACM in 1995, courtesy of Peter Deming. (Though it was oddly stated.) Until just recently this was at
acm.org/publications/policies/copyright-policy-v2/
but they've taken it down.

Fortunately, the Internet Archive has it, at
http://web.archive.org/web/20000816003701/http://www.acm.org/pubs/copyright_policy/version2.html#Background

=== SECRECY. We kept the main stuff in xu88 secret. We thought that the enemies were the government (who would spy) and IBM (who would compete). We were wrong about the latter.

=== INNER CONCEPTS OF XANADU GREEN

We did not deal with "files". A disk was addressed with a numerical system called "tumblers" (explained in my book "Literary Machines"-- editions since 1985). A tumbler was a multipart number with its own tricky arithmetic.

A tumbler address could refer to anything from one character up to the whole universe. (Tumbler arithmetic was the inverse of transfinite arithmetic, which both Roger and Mark had studied.)

=== THE MAIN SECRETS: TUMBLER ENFILADES

The enfilade concept-- a tree for editing stored conents, which I had invented around 1970 for the Hypertyper project-- was wildly extended in Xanadu Green. There are three enfilades in Xanadu Green, defining documents and searches. (These will be explained in a forthcoming edition of "Literary Machines," if I live long enough.)

The group also worked out a General Enfilade Theory, which has been partly lost.

=== THE DISASTROUS FATE OF XANADU GREEN

Autodesk backed the Xanadu project in the fateful year of 1988, Roger's target year, but unfortunately the group-- no longer headed by Roger Gregory-- began a four-year redesign, after which Autodesk dropped the projet.

The code of Xanadu Green was put into open source in 1999.

At that time, in a blaze of glory, Xanadu Green was demonstrated by Ka-Ping Yee with his Thomas Jefferson demo. (We will try to get that demo onto the Internet Archive, possibly as a Linux virtual machine.)

WHAT XANADU GREEN STILL NEEDS:
- multi-user extension
- larger address space

and a few other things. Contact Roger Gregory if interested.

=== === === MY HYPERTEXT WORK SINCE 1979

I have continued working toward my Decent Document System these many years, using the concepts from Xanadu Green and earlier--

- EDL-based text editors and viewers
- visibly connected pages and windows
- micropayment by the character (specified by content publishers for specific content, which may be listed in an EDL).

I will discuss each of these areas of work in turn, and then three projects which unified some of these methods.

=== === === EDL-BASED EDITORS

=== THE DESIGN AT DATAPOINT. In 1981-2, at Datapoint, I designed an editor based on an EDL. It was called "Vortext", and part of their proposed "Vantage" office software suite.

It maintained three parallel files for a user--
- cumulative text, unchanging (as in Hypertyper)
- EDLs of documents (changeable and versionable)
- link overlays, as in Xanadu Green, except maintained in a relatively conventional file.

It would also have intercomparison that showed identities (transclusion).

The Vortext design (now lost) was submitted as part of the overall proposal by Datapoint's Advanced Systems Division. It was rejected by management.

Not much later, Datapoint went under. The Vantage project might have saved the company, but we'll never know.

=== DESIGN AT KEIO BY KENICHI UNNAI, 1997. At Keio University, in my OSMIC seminar (Open System for Media Interconnection), student Kenichi Unnai unexpectedly delivered a complete EDL-based text system, even with forking versioning. It had a Perl server and an EMACS client.

=== === === VISIBLY CONNECTED PAGES AND WINDOWS

Visible connection has been an aspect of my designs since the 1960s, enumerated below.

I am pleased that Jason Scott has recently proposed the term "Nelson documents" for visibly connected pages.

=== MOCKUP, 1960s. At
xanadu.com/xUniverse-D6
the first two pictures are mockups I made in the 1960s.

=== PING'S BRILLIANT DEMO, 1999. At
xanadu.com/xUniverse-D6
the third illustration on that page is an actual screenshot from Xanadu Green-- a functioning interface to done by Ka-Ping Yee around 1999, showing transclusions between two extand versions of the Declaration of Independence, both written by Thomas Jefferson.

=== TRANSPOINTING AT THE ACM!, 1995. The ACM published my peer-reviewed article, "The Heart of Connection: Hypermedia Unified by Transclusion." Communications of the ACM, 38:8 (August 1995), 31-33.

I believe this was the first publication of visible connections (called in the article "transpointing windows") in a refereed publication. Regrettably, this piece is now behind the ACM's wall.

=== SAPPORO HYPERLAB, 1997. The "Tatsuno Otoshigo" (Sea Horse) project at Sapporo HyperLab showed visible connection based on EDLs. Unfortunately no documentation or screenshots currently available. Done with Mr. K. Ookubo, using the IntelligentPad system of Professor Yuzuru Tanaka.

=== COSMICBOOK, 2003, implemented by Ian Heath from my design. See illustration at Cosmicbook homepage,
xanadu.com/cosmicbook/

from which the program (called a "free reader") may be downloaded. IT WORKS but further development is unlikely. However, thoughtful users will be able to create linked documents of their own in this format. Anyone is welcome to write up directions for use, I don't have time.

=== Microsoft Word!, 2007. Visible connection is now a feature of Microsoft Word in .docx, but only in printout-- not in any on-line documents. This can be found on Google as "docx annotation". Their system is not easy to use.

=== === === MICROPAYMENT FOR CONTENT PORTIONS

I have continued to work in the area of micropayment.

=== Hypercoin Seminars, 1990s. In the 1990s I held "Hypercoin" seminars in San Francisco, under the sponsorship of Kazuhiko Nishi of ASCII Corporation, investigating possible methods that were in the air at that time..

=== Patent, 2000. I was issued a patent for a network payment system (United States Patent 6,058,381, entitled "Many-to-many payments system for network content." This was purchased by Intellectual Ventures, Inc.

=== Royalty server, 2016-present. Work with Edward Betts on a micropayment simulator for sale by the character. We have the domain Royalty.pub.

=== Iota 2018, maybe. It may be that the "Iota" micropayment system is suitable for microtransactions at the level I propose. The jury is out on the workability of this system.

=== === === UNIFYING PROTOTYPES, bsed on conventional addressing

Several Xanadu prototypes have put together different parts of Xanadu-- combinations of EDL, overlay links (xanalinks), visible transclusion, even micropayment.

However, since the Web, I have had to build EDLs on the file-based addressing of today's URL conventions. This loses many of the capabilities that were possible in the brilliant tumbler-space of Xanadu Green. (Resuscitating Xanadu Green remains the job of Roger Gregory. There is still hope.)

=== Hypertransaction System, 2000. At Keio University, the Hypertransaction System, sponsored by MITI, with professor Hajime Ohiwa and main programmers Andrew Pam and Yousuke Igarashi. The server was in Perl.

The Hypertransaction project brought together--
- EDL delivery
- visible links
- visible transclusions, paid for by micropayment
- simulated micropayment and user accounting

It was deemed to be a very successful project by the university.

However, it was large and un-portable-- another demonstration of concept.

=== XanaduSpace, 2003-7, with Robert Adamson Smith. This system, which I demonstrate frequently, is a my canonical working demo of--

- EDL assembly
- parallel pages, visibly connected in a multipage package
- visible links
- visible transclusions

Rob is a master of 3D, and the demo works beautifully. Unfortunately the document can't be changed.

See video demonstrations at
youtube.com/watch?v=Bqx6li5dbEY
and
youtube.com/watch?v=1yLNGUeHapA

See writeup expounded at
xanadu.com/XanaduSpace/btf.htm

The XanaduSpace demo program can be downloaded (Windows only) at
xanadu.com/xuspViewer.html

Unfortunately, further development is impossible due to the complexity of the code. (Two youngsters in Connecticut, John Ohno and Jonathan Kopetz, spent several years trying to fix it.)

=== OpenXanadu, 2014. This is a beautiful browser-based viewer by Nicholas Levin, visible at
xanadu.com/xanademos/MoeJusteOrigins.html

It shows the same document as the XanaduSpace demo-- "Origins," by Moe Juste-- but without the links. Nicholas had to cut down the spec to finish in the available time, and did so brilliantly, so it only shows transclusions, not xanalinks.

(Note that this will work with other edit decision lists, in the proper format, at
xanadu.com/openxanadu/Phase%201/OpenXanadu.html?url=your_url_goes_here

It works if you study Nicholas' EDL format, and put your EDL at some location, represented by
url=your_url_goes_here

=== xuCamb, 2016 "Cambridge Xanadu"

This system, done with fabulous programmer Edward Betts, is largely browser-based. Edward has done a wonderful job of putting all the pieces together.

See demo at
youtube.com/watch?v=72M5kcnAL-4

This brings together actual
- EDL
- links
- visible transclusions
- simulated micropayment

Unlike the previous EDL systems (XanaduSpace, OpenXanadu), users can put in their own EDLs with relative ease.

However, it is still only a prototype, and not ready for general deployment.

=== === === MY ONGOING XANADU DESIGN: PARALLEL PAGES

The Xanadu design has essentially resolved to one basic document concept: parallel pages with visible connections-- as you can see in the above demonstrations of XanaduSpace, OpenXanadu and xuCamb.

Parallel connected pages have many uses--
- summary and details
- parallel timelines
- separate but interlocking narratives
- commentary
- footnotes
- variant versions
- parallel versions for different audiences

and many other purposes for which conventional sequential text is unsuited.

This design remains the center of my work.

=== === === END OF HYPERTEXT NARRATIVE

=== === === WHAT ELSE CAME OF MY GRAND PLAN

(ZIGZAG¬Æ IS NOT DISCUSSED IN THIS DOCUMENT. It started much later, in the 1980s, and so I will not discuss its many variants and derivatives here.)

For over a decade I put a lot of effort into the other areas of my initial plan--

=== STARTING A PERSONAL COMPUTER INDUSTRY: The Itty Bitty Caper

(I never did incorporate as General Creative, but I have the website.)

I knew personal computing was coming (just as Bill Gates did), and in 1974 and 1975 (before the Apple II) I was a partner in a computer kit store, the Itty Bitty Machine Company. Wrangling with partners, I narrowed my plan to a line of personal software in the TRAC language--
- Hypertyper (with email provisions, though email did not yet exist)
- a calendar / scheduler with PERT features (Planorama)
- a database system something like Whatsit (ThingEez)
- an accounting system (Ledgerdomain) that would keep track also of gifts and favors
- a graphical animator on the character screen (Flapdoodle)

This did not work out. My partners in the store relied on the opinions of a pompous digital engineer who said my ideas were impossible. Nevertheless, collaborator Bill Barus and I created an extremely good version of TRAC to run on the 8080 under CP/M. Using this, Bill and I implemented the Flapdoodle animator. It was much enjoyed at Swarthmore College.

Unfortunately the rightsholder in TRAC, Calvin Mooers, whom I had previously supported in his maneuverings, rescinded his oral permission to use the language, and we were stuck.

=== VIDEO EDITING BY COMPUTER

In 1965 I made a proposal to Lou Lessard, the person in New York who was supposedly the top video editing guy. He later told me he looked at it, went cold all over and put it in his desk drawer for months.

I applied for a software patent on computer video editing in 1965-- my system would link the shots to the script, like drawing parallel lines on a shooting script-- a method that was used to log what shots have been taken-- but I didn't have the money to follow the patent application through.

I dropped it thereafter. In 1988 Avid brought out the first computer-based movie editing system. It has had many imitators.

However, none of them link to the script, as mine did.

=== REALISTIC PSEUDO-PHOTOGRAPHY (now called CGI)

In 1961 I figured out ray tracing, and for years continued to think it out spatially, with hundreds of notes and diagrams.

In 1965 and later, I gave two presentations-- I think one at SMPTE and one at SID, but nobody was interested.

The 1968 one was called "Realistic Pseudo-Photography by Computer: The Fantasm System."

I sent a long Fantasm proposal to CBS Laboratories (I completely forgot, but just found it). They didn't understand it, but they hired me for something else.

I sent a Fantasm proposal to Stanley Kubrick, and he wrote back: "Dear Ted: What is it?" I had no time to follow up.

However, I continued to work on the graphical methods, which I visualized spatially. I correctly realized that you didn't need exact formulas for the surfaces (like the DAC-1 system at General Motors), but that a surface could be well represented by triangles (as in many methods today).

In 1970 I filed a patent application for a special-purpose hybrid computer that would represent triangulated surfaces and explore them for realistic photography.

My own CGI methods, and my strange machine for surface representation, are described in my book "The Scene Machine", available from Lulu--
lulu.com/shop/theodor-holm-nelson/the-scene-machine/paperback/product-21454515.html

After that I realized much more competent guys would get into it, and dropped out of the realistic graphic field. Soon, in the early seventies, I visited what would become the Pixar Group at New York Institute of Technology, and saw their great work beginning. And soon after that, the SIGGRAPH graphic meetings began showing the heated progresss of this field. My 1965(?) prediction of realistic dinosaurs was vindicated by "Jurassic Park".

=== PRINCIPLES OF INTERACTIVE DESIGN

Over the years I have called my principles of software design--
- splandremics

- fantics
- virtuality (the original meaning, not to be confused with 3D)

I have never had time to write them up, although I have occasionally given seminars and courses under the name "Cinema of the Mind,Ñ¢".

=== MOVIES, HYPERMEDIA AND THEATRICALS

I have always thought I would get back to movie-making, and have always had one or two scripts on the back burner. Of late that has been a pitch entitled "Mother of Frankenstein: Mary Shelley Goes to Hollywood," which is published.

In the 1960s I imagined many forms of hypermedia, some of which exist now. I planned more radical theatricals, such as a "Lord of the Rings" presentation with audiences in the round and moving projection screens. (It is interesting to note that the movie rights to "Lord of the Rings" were available for $10,000 in the sixties, when I dreamt of this.) [To my knowledge, no one has implemented moving screens in a theater-in-the-round environment.]

=== === === SPECIAL THANKS

With all my heart I thank my late wife, Marlene Mallicoat, for her help and support from 1992 till her passing; and my first wife Deborah Stone and third wife Lauren Sarno, both together on our cramped houseboat in January 2018, who have given me time and space to write and rewrite this, even sorting Tolstoy noodles in the kitchen.

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